his issue: **Press Feeding • Spring Inspection • Retooling Saves Steel**

JANUARY, 1952

TOOLING and PRODUCTION

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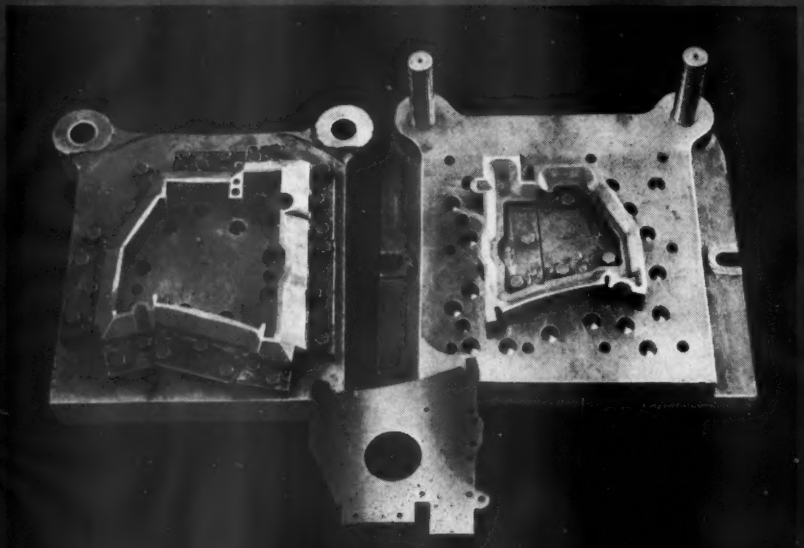

How to *Cut Costs and "Corners"* on Your Blanking Dies

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COMPOSITE DIE SECTIONS

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You can save steel and time in the making of dies for blanking, trimming, beading, or any application involving the cutting of sheet metals to regular or irregular shapes, by assembling them from our Composite Steel Die Sections.

These prefabricated die parts consist of fine tool steel cutting edges, in a selection of grades, electrically welded by a special process to non-hardenable mild steel bases. Thus, screw and dowel holes may be easily drilled after heat treating, and there are numerous other advantages that will be immediately obvious to the die maker.

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Clamping Pressure: CV40-B5 — Five times applied air pressure.
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The Magazine of

TOOLING and PRODUCTION

TOOL & DIE JOURNAL

1975 Lee Road • CLEVELAND 18, OHIO
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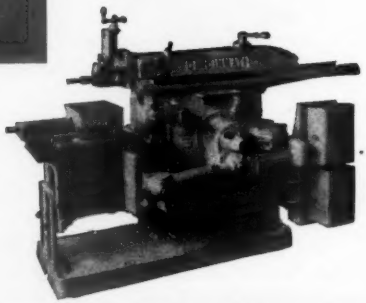

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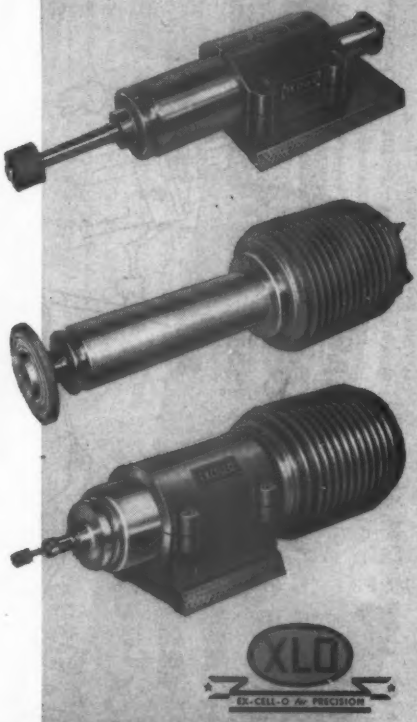

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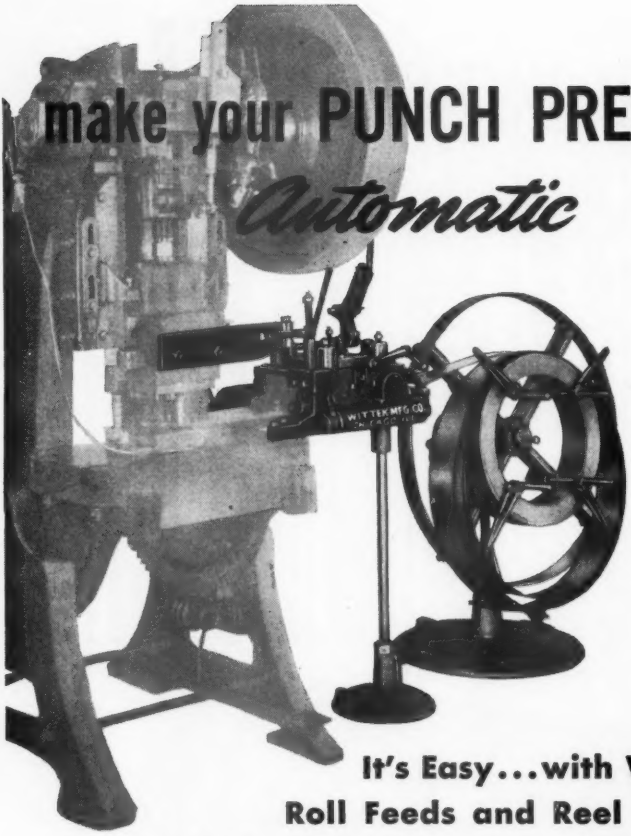

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Wittek Reel Stands facilitate handling coiled stock.

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Automatic ROLL FEEDS AND REEL STANDS WM CO.

The Solution To Your Die and Mold Cleaning Problems

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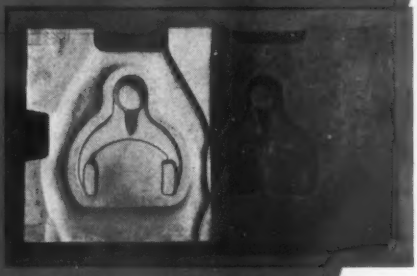
WET BLASTING



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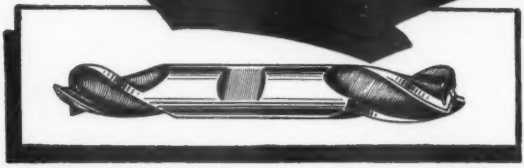

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Johansson

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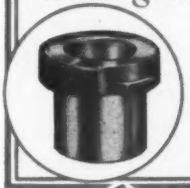

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The Only MASTER COLLET
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Style "S"
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Pads Interchangeable Among
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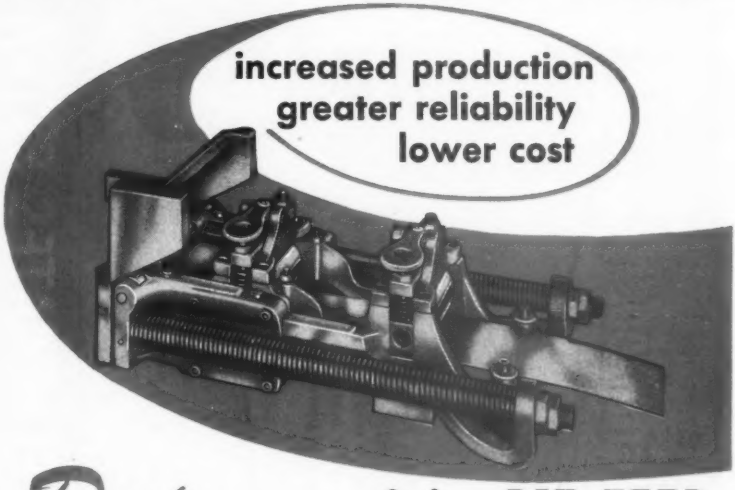
Style "B"
Master Feed Fingers and Pads

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PUNCH PRESS OWNERS REPORT



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The amazing simplicity and steady reliability of the 3″ Die Feed have made it a favorite with punch press owners everywhere.

Easy to install, it has no complicated parts to get out of order, adjustments are few and simple and top quality material and workmanship assure millions of cycles without expense.

Can be mounted on die set or bolster plate to feed from any direction. Feeds coiled materials such as steel, copper, brass, aluminum, mica, paper, fibre, rubber, plastic. Will not mar smoothest surfaces.

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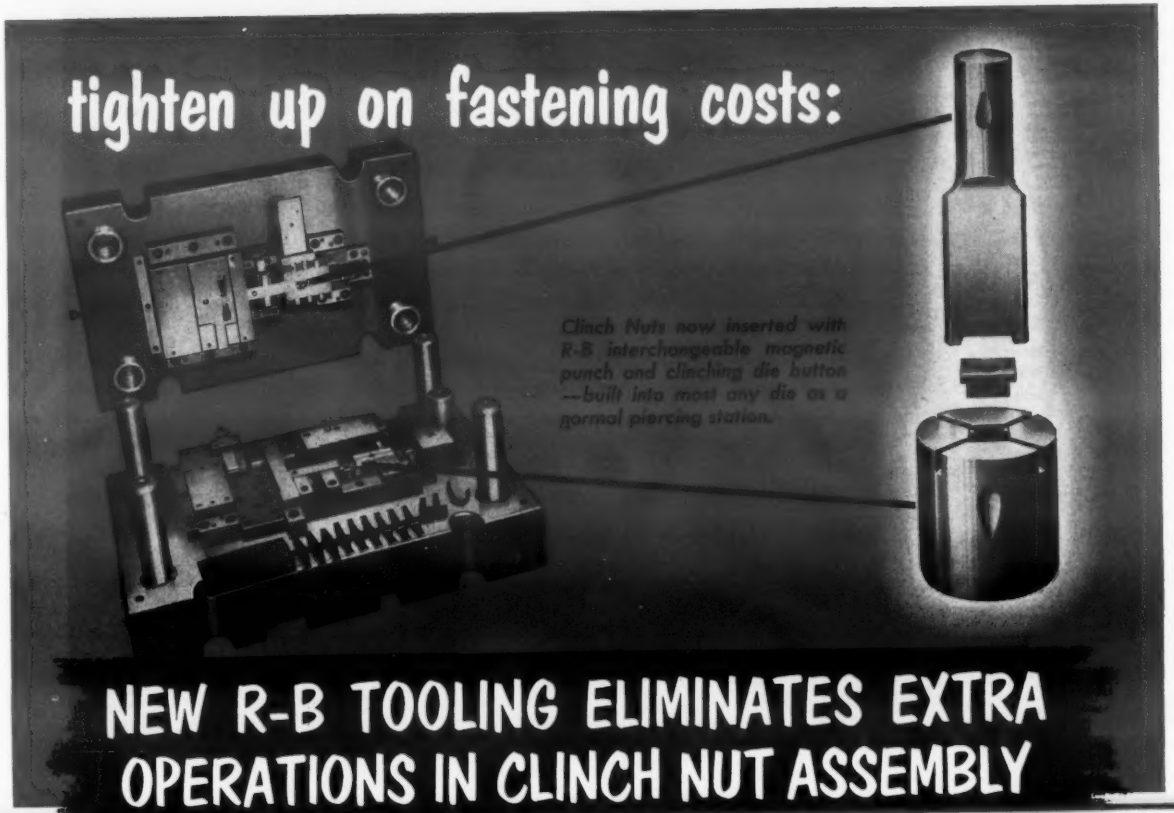

tighten up on fastening costs:
Clinch Nuts now inserted with R-B interchangeable magnetic punch and clinching die button —built into most any die as a normal piercing station.
NEW R-B TOOLING ELIMINATES EXTRA OPERATIONS IN CLINCH NUT ASSEMBLY

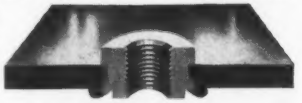
Now you can insert Clinch Nuts in your part die button as lips on the die button clinch the

OPERATIONS IN CLINCH NUT ASSEMBLY

Now you can insert Clinch Nuts in your part *as you make it:* no other operations are necessary. Savings in assembly time and tooling are created by the new R-B interchangeable magnetic punch and clinching die button, which become a normal piercing station easily built into any piercing die. Just one stroke of the press pierces and clinches a nut.

Clinch Nuts are fed automatically to the piercing station from a hopper and flexible feed chute adjacent to the press. The nut does the piercing; the slug falls through the die button as lips on the die button clinch the nut to the part.

This new R-B tooling also makes Clinch Nuts cost-saving substitutes for welded nuts and similar fasteners. Send today for the full story that shows the way to lower fastening costs. **Allied Products Corporation, Richard Brothers Division.**



R-B Clinch Nut tooling swages nut and part, producing a strong key which defies rotation.

ALLIED PRODUCTS CORPORATION
RICHARD BROTHERS DIVISION
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Keeps Costs Down on Precision Parts

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MODEL 2-H TURRET LATHE

Available with 6' or 7' bed, 28¼" or 40½" maximum spindle nose to turret face distance; 1" collet capacity; 1⅜" hole through spindle. Turret has adjustable feed stop for each tool, power feed trips-out at stop setting. Double tool slide carriage.

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Building Better Tools Since 1906

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Time after time after time, the application of **Portelvator** to material positioning at the machine has resulted in such savings that problems, which seemed to have only a remote relationship to the operation, have vanished. If you have one machining operation where mechanical material positioning can be applied, your prospect for cost reduction is excellent.

Write for information about the easiest way to replace brawn, your most expensive component. Ask for our free Bulletin No. P-503.

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THE *Hamilton* TOOL COMPANY
832 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

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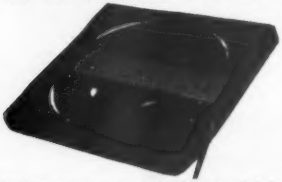
Specify ATLANTIC

BAND SAW BLADES

for Smoother

CONTOUR CUTTING

ATLANTIC SAWS meet all of your requirements for a superior blade on complicated die and fixture radius cutting. ATLANTIC specializes in accurate milled and precision set teeth, hardened to exact temper.



Atlantic's strong, practical box, plainly marked on sides and top. Remains in good condition until entire coil is used.

ATLANTIC'S special alloy steel insures longer wear and easier welding.

ATLANTIC'S one temper saw for all metals reduces stock you have to carry. Cut to length and welded, ready for use. Packed in strong Atlantic box. Write for new Atlantic Catalog.

Atlantic Saw Mfg. Co.

INCORPORATED

Exclusively Manufacturers of Band Saw Blades

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NOW... ONE PASS

drills hole 3½ in. deep in 18-8 stainless steel

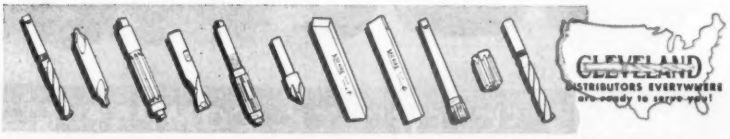
This was a slow and difficult job. There was considerable tool breakage, even though the operator made several pull-outs for chip relief on each hole. ◈ When a *Cleveland* Service Representative was called in, he carefully analyzed the set-up . . . and recommended the CLE-FORGE High Speed Drill illustrated at the left. This is a stock drill with a heavy web, and with flutes designed for easy chip removal. Now—because of the greater strength and rigidity of this drill—the deep holes are drilled in one pass. Breakage has been greatly reduced. ◈ Whenever *you* have a drilling problem, get the advice of a *Cleveland* Service Representative. Contact our nearest Stockroom, or . .

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street **Cleveland 14, Ohio**

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5
Los Angeles 58 • London W. 3, England



ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR FOR THESE AND OTHER *Cleveland* TOOLS

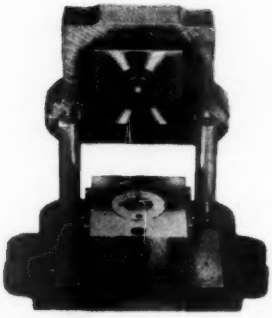
SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

A MUST wherever WASHERS are made!

HOVIS

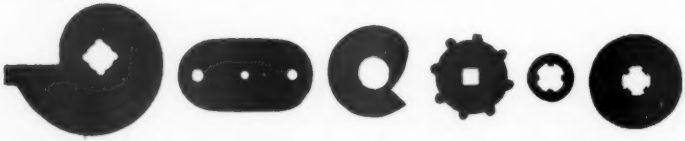
OFFERS YOU THIS SIMPLE, UP-TO-THE-MINUTE METHOD

There's no need to make a complete new Die for any type washer or blank. The HOVIS UNIVERSAL WASHER DIES provide a Master Holder and by merely changing 5 SMALL, EASILY REMOVABLE PARTS the new washer or blank is produced . . . Special sets of parts are available for use in Master Washer Units enabling customers to produce irregularly shaped pieces and shallow draws. Multi-Washer Dies are also designed and manufactured.



Made in 5 sizes:
¼"—1½"—2½"—4"—6".

Write for literature.



HOVIS SCREWLOCK COMPANY

8100 E. NINE MILE ROAD **VAN DYKE, MICHIGAN**
Phone: Slocum 7-1334 **Suburb of Detroit**

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

Quartz.....Formica....Copper Tubing?

INGENIOUS Delta SET-UPS CUT THEM ALL

Cutting Quartz National Scientific Products Co., Chicago, built a special mounting for Delta 14-inch drill presses, and fitted them with abrasive wheels, to cut wafer-thin quartz crystals for communication instruments. Side-mounted, pivoted drill press heads are actuated by a hydraulic-cylinder power feed. Curtain prevents lubricant splashing

Cutting Copper Tubing

LeRoi Co., Milwaukee, fitted an adjustable reel to a Delta cut-off machine to cut copper tubing to length. Reel cuts handling time and labor costs, and permits under-bench storage of a variety of sizes

Faced with problems of machining out-of-the ordinary materials, many shop superintendents and tool engineers have found the solution by adapting low-cost, high-precision Delta wood and metal working machines. Here are typical examples:

Cutting Formica

Boothcraft, Inc., Jamestown, N Y., cuts Formica for restaurant counter and table tops on Delta Unisaws. Boothcraft also uses Delta disc sanders for finishing the edges of sheets of Formica, which has a hardness approaching steel.

There's a Delta Power Tool for Your Job-

WOOD OR METAL WORKING

53 MACHINES—246 MODELS—MORE THAN 1300 ACCESSORIES

For Delta dealers, see your Classified Phone Directory under "Tools"

DELTA POWER TOOL DIVISION

Rockwell

MANUFACTURING COMPANY

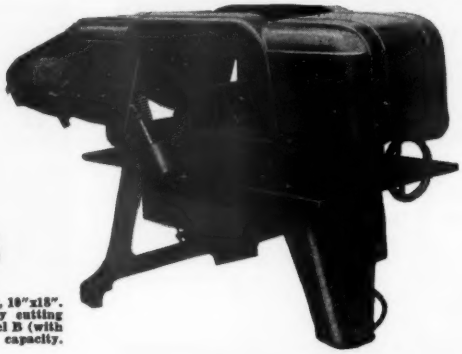
613A E. VIENNA AVENUE • MILWAUKEE 1, WISCONSIN

SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

RIGHT NOW A JOHNSON METAL CUT-OFF BAND SAW

IS A *Better Investment* THAN EVER!

Make Full Use of Present Steel Stocks



Model J Pictured. Capacity, 18"x18". Available as a wet or dry cutting machine. Also Junior Model B (with or without casters) 5"x10" capacity.

Yes, present-day steel shortages present problems. Maybe you are having your troubles getting the sizes you require. . . . That's where a Johnson Band Saw can fit into your picture to added advantage. You probably have material in your stock rack now that you could cut to the sizes you need by using a Johnson Saw, which otherwise would not be available. So we urge that you write us, get the catalog and full details about Johnson Band Saws, the leaders in their field. . . . The machines that last indefinitely and deliver the most in time-saving, accuracy and efficiency.

There is a Dealer Near You

JOHNSON MANUFACTURING CORP.
ALBION, MICHIGAN

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

GET INTO PRODUCTION

Faster!

SEND FOR YOUR FREE COPY OF THIS NEW BOOKLET TODAY!

You save time when you "tool up" with Danly Die Sets . . . preferred by diemakers everywhere. Check the unique precision features that mean faster die completion and longer production runs . . . see how the nationwide system of Danly assembly branches reduces costly delivery delays. Write for your copy now . . . Danly Die Sets are certain to help you meet production schedules.

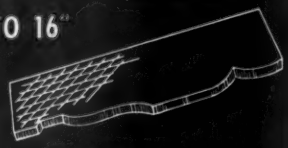
DANLY

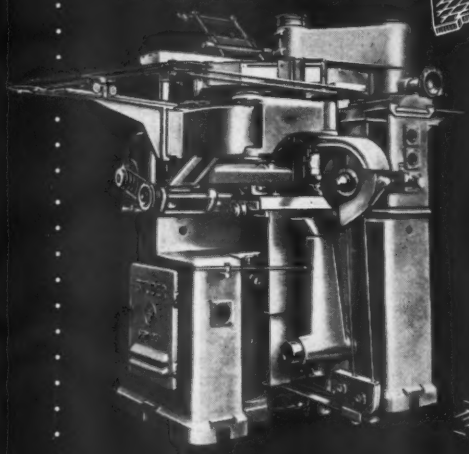
DANLY MACHINE SPECIALTIES, INC. 2100 South Laramie Avenue, Chicago 50, Illinois

THE STUDER PSM-250

GRINDS PROFILES UP TO 16"

IN ONE SETTING

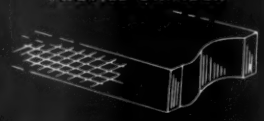




LARGER FLAT OR CIRCULAR FORM TOOLS, SECTIONAL DIES, GAUGES AND OTHER PROFILE PARTS CAN NOW BE ACCURATELY GROUND ON THIS

NEW STUDER

PROFILE GRINDER

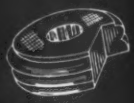


INCREASED CAPACITIES

The PSM-250 grinds profiles up to 16" long in one setting and accepts flat work pieces up to 4½" thick and rounds up to 10" diameter. Templates up to 24" long are easily accommodated. The adjustable pantograph can be set in any ratio from 1:1 to 1:10.

CLEARANCE ANGLE AND RELIEF GRINDING

Attachments are available to grind different clearance angles on flat form tools—*without correcting template form*, and, to relief-grind punching and drawing dies.



AUTOMATIC TRACER GUIDE

This attachment automatically guides tracer bar along the template. The automatic, uniform feeding produces improved surface finishes and increases the life of grinding wheels. To guide tracer bar by hand, two screws are loosened to detach the device.

PRECISE GRINDING

Profiles can be ground to a tolerance of ± 0.0004". Closer limits are obtainable when large ratios of reductions are employed.

WRITE FOR CATALOG ILLUSTRATING AND DESCRIBING THE NEW STUDER PSM-250

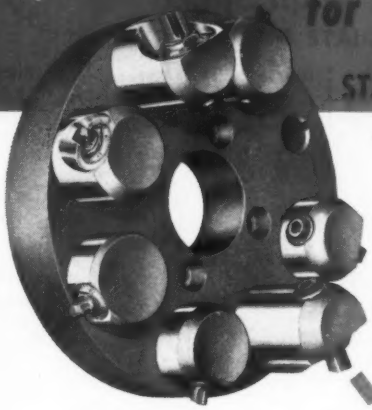
COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools— from Small Bench Lathes to Large Boring Mills

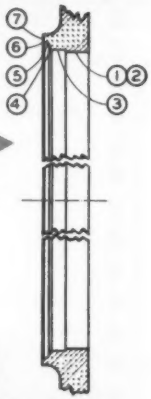
IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

MICROBORE
by DeVLIEG

Special BORING BARS
for PRECISION WORK
Equipped with
STANDARD MICROBORE TOOLS



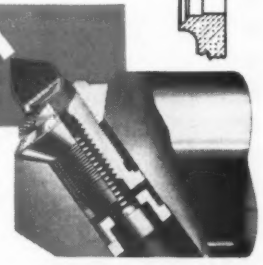
Special bar used in boring, counterboring and chamfering (in one operation), a cover for a jet engine combustion chamber.



OPERATIONS
1. Rough Bore 10.855 Dia.
2. Finish Bore 10.8755 Dia.
3. Bore 11.000 Dia.
4. Form 30° Chamfer
5. Bore 11.252 Dia.
6. Form 45° Chamfer
7. Face Boss

There is a Microbore representative in your area who will be pleased to call on you for further consultation.

BORING •
TURNING •
FACING ■



ILLUSTRATED CATALOG MAILED ON REQUEST

Each tool independently adjusted by proven micrometer, vernier principle.

DeVLIEG MICROBORE COMPANY
480 FAIR AVENUE • FERNDALE 20, MICHIGAN, U. S. A.

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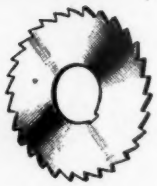
Victor's Specials Deserve Your Attention!

METAL SLITTING SAWS

Hollow Ground • High Speed

FIRST QUALITY • IMMEDIATE DELIVERY



Diameter	Thickness	Hole	Price
2½"	1/32"	7/8"	$2.52
2½"	3/64"	7/8"	2.52
2½"	1/16"	7/8"	2.52
2½"	3/32"	7/8"	2.52
2½"	1/8"	7/8"	2.61

Diameter	Thickness	Hole	Price
3"	1/32"	1"	$2.97
3"	3/64"	1"	2.97
3"	1/16"	1"	3.06
3"	3/64"	1"	3.40
3"	3/32"	1"	3.06
3"	7/64"	1"	3.50
3"	1/8"	1"	3.15
3"	5/32"	1"	3.70
3"	3/16"	1"	3.80

Diameter	Thickness	Hole	Price
3½"	1/32"	1"	$3.87
3½"	3/64"	1"	3.96
3½"	1/16"	1"	4.05
3½"	3/64"	1"	4.23
3½"	3/32"	1"	4.23
3½"	7/64"	1"	4.50
3½"	1/8"	1"	4.50
3½"	5/32"	1"	4.68
3½"	3/16"	1"	4.95

Diameter	Thickness	Hole	Price
4"	1/32"	1"	$3.87
4"	3/64"	1"	3.96
4"	1/16"	1"	4.05
4"	5/64"	1"	4.70
4"	3/32"	1"	4.23
4"	7/64"	1"	5.00
4"	1/8"	1"	4.50
4"	5/32"	1"	4.68
4"	3/16"	1"	4.95

Diameter	Thickness	Hole	Price
5"	1/16"	1"	$5.22
5"	3/32"	1"	5.67
5"	1/8"	1"	5.94
5"	5/32"	1"	6.30
5"	3/16"	1"	6.66

TOOL OF THE MONTH

Wire Gauge
High Speed Straight Shank Drills

Size	Price per Doz.
51-60	$1.58
61-70	2.75
71-80	3.30

Combines Quality, Service and Price!

VICTOR MACHINERY EXCHANGE, INC.
DEALERS IN TOOL ROOM EQUIPMENT
251-P Centre St. • New York 13, N. Y. • Phone CAnal 6-5575

The Hamilton Varimatic® Super-Sensitive, Variable Speed Drilling Machine
The Hamilton A-M Super-Sensitive Drilling Machine
The Hamilton Super-Sensitive Tapping Machine
DRILLED HOLES TAPPED

Hamilton DRILLS AND TAPPERS

MAKE TIME • SAVE COSTS ON ACCURATE SMALL HOLE PRODUCTION

Small holes . . . *tiny holes* . . . in materials of such diverse characteristics as fiber and monel, ceramic and bronze, are being drilled and threaded speedily, accurately, *profitably* . . . NOW . . . by thousands of Hamilton Drills and Tappers.

The Hamilton VARIMATIC® DRILL,
The Hamilton A-M DRILL,
The Hamilton TAPPER,

each a bench type, super-sensitive machine with ample clearances and travel, incorporate such precision that work is always held well within the tolerance allowed, and such stamina that they maintain their accuracy year after year even under heavy production loads. Our free Bulletin No. V-472 provides full information including specifications. Write now! Tomorrow you may need the information.

THE Hamilton TOOL COMPANY
832 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

FULL-SPEED AHEAD

IS THE PRESENT-DAY DEMAND

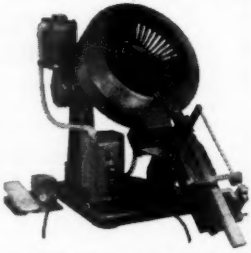
and You Can Command It With

D.P.S. MOTORIZED
Selective Feeding
HOPPER UNITS

Hopper feeding 30 caliber shell discs, concave side up, to press for drawing operations.

Modern production methods demand more speed and accuracy in the selection and feeding of parts than can be accomplished by hand . . . Our 25 years experience as pioneers in the assembly field enables us to ably meet this demand with the D.P.S. Motorized Hopper Units, the outstanding selective feeding devices with which production parts of a wide variety are selected, oriented and fed in a given position for primary and secondary operations . . . They are a completely self-contained unit, including drive and feed track. They are easily adaptable to presses, centerless grinders, thread rolling and slotting machines, also special machines . . . Six sizes, 8″, 10″, 12″, 16″, 24″ and 30″ diameters for handling various sizes of parts. No matter what your feeding problem is, we can meet your requirements. Designers of special equipment will also be interested.

Sixteen-inch hopper mounted on tapping machine equipped with air-operated dial—completely automatic operation.



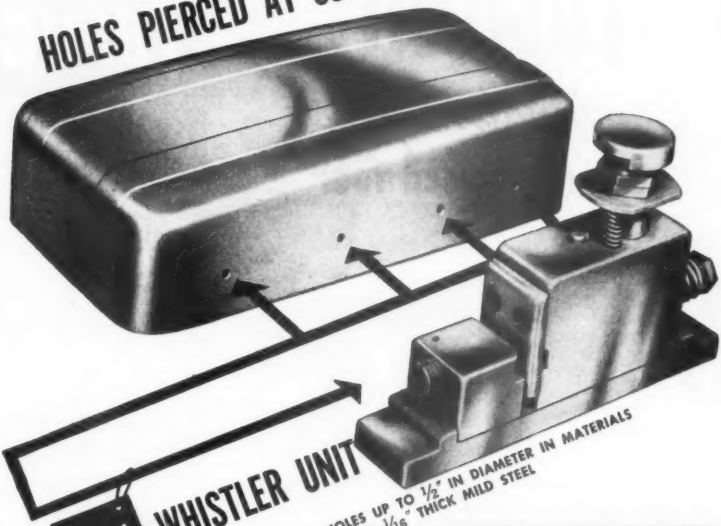
Counting and feeding hopper with adjustable escapement to accommodate varying quantities.

Send for further details, also information about D.P.S. Power Screwdrivers, Nut Drivers and Special Assembling Machines.

DETROIT POWER SCREWDRIVER CO.

2827 W. FORT ST. DETROIT 16, MICHIGAN

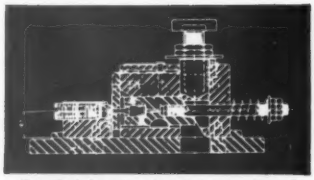
HOLES PIERCED AT 90° ANGLE...



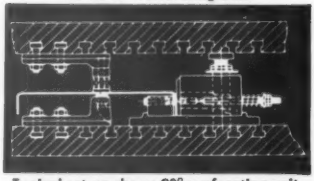
with NEW WHISTLER UNIT

PERFORATES HOLES UP TO ½" IN DIAMETER IN MATERIALS TO 1/16" THICK MILD STEEL

Extruded shapes, ells, angles and other molded, shaped or fabricated pieces are easily pierced from the side at 90° with HU-50 Perforating Units. Quickly set up and adjustable, these units may be used separately or with standard perforating equipment. The advantages provided by other Whistler Adjustable Dies are retained. Absolute accuracy is assured. Quick change-over of hole arrangements can be made...in many cases, on the press. Production economies and speeded up operating schedules are effected. Continued re-use of units in different groupings spreads initial cost. It makes sense to look into the use of Whistler Adjustable Dies for all perforating, notching, slitting or rounding operations.



Detailed drawing showing operation of HU-50 90° Perforating Unit.



Typical set-up shows 90° perforating unit operated in conjunction with standard perforating equipment.

DETAILS EXPLAINED IN CATALOG NO. 48

Get the facts about this 90° perforating unit in a hurry. Your copy of this catalog will be sent at once upon request.

S. B. WHISTLER & SONS, Inc.

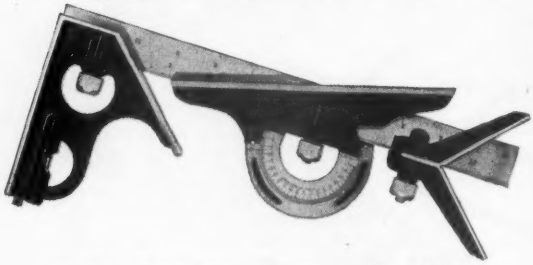
748 Military Road • Buffalo 17, N. Y.

SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

TUMICO

Combination Sets

"your most used tool"



Used as a Try Square, Miter Square, Height Gage, Marking Gage, Depth Gage, Center Finder, Protractor, Bevel Gage, Scriber, Level, Steel Rule, and Straight Edge; the versatile Tumico Combination Set is your best tool buy. The bevel protractor is reversible. The blade, drop forged square, and center head are hardened. All parts of the set are accurately ground. It performs the duties of many tools, saves time, space and money. Write for new catalog.

TUBULAR MICROMETER CO.

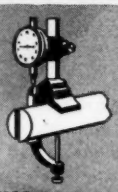
ST. JAMES, MINNESOTA

SEATTLE • LOS ANGELES • DENVER • DALLAS • CHICAGO • MINNEAPOLIS • KANSAS CITY
DETROIT • ATLANTA • NEW YORK • TORONTO, CANADA • EXPORT OFFICE: CHICAGO

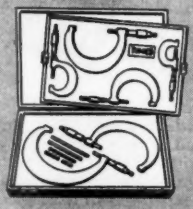
FOR EVERY JOB

TUMICO

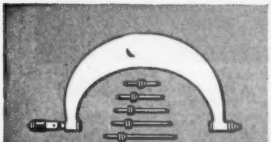
PRECISION MEASURING INSTRUMENTS



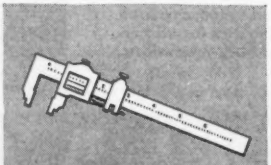
TUMICO POST GAGES
Precision micrometer or dial indicator instruments adaptable to a wide variety of uses. 10 models.



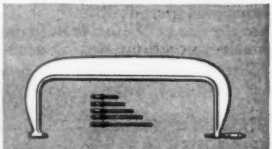
TUMICO MICROMETER SETS
Complete sets for a broad range of accurate measurement operations. From 0" to 30" in 1" steps.



TUMICO
OVER-THE-BAR MICROMETERS
Precision bore measurement without removing boring bar. 11 models from 3" to 28".



TUMICO VERNIER CALIPERS
Precision made. Accurate, clearly etched graduations and numerals. 24 models from 6" to 48".



TUMICO BAR MICROMETERS
Provide a wide range of precision measurement with low investment. 30 models from 6" to 168".

Standardize on PRATT & WHITNEY REAMERS

—they have the UNIFORM QUALITY, PRECISION AND LONG LIFE required to meet Today's Critical Needs

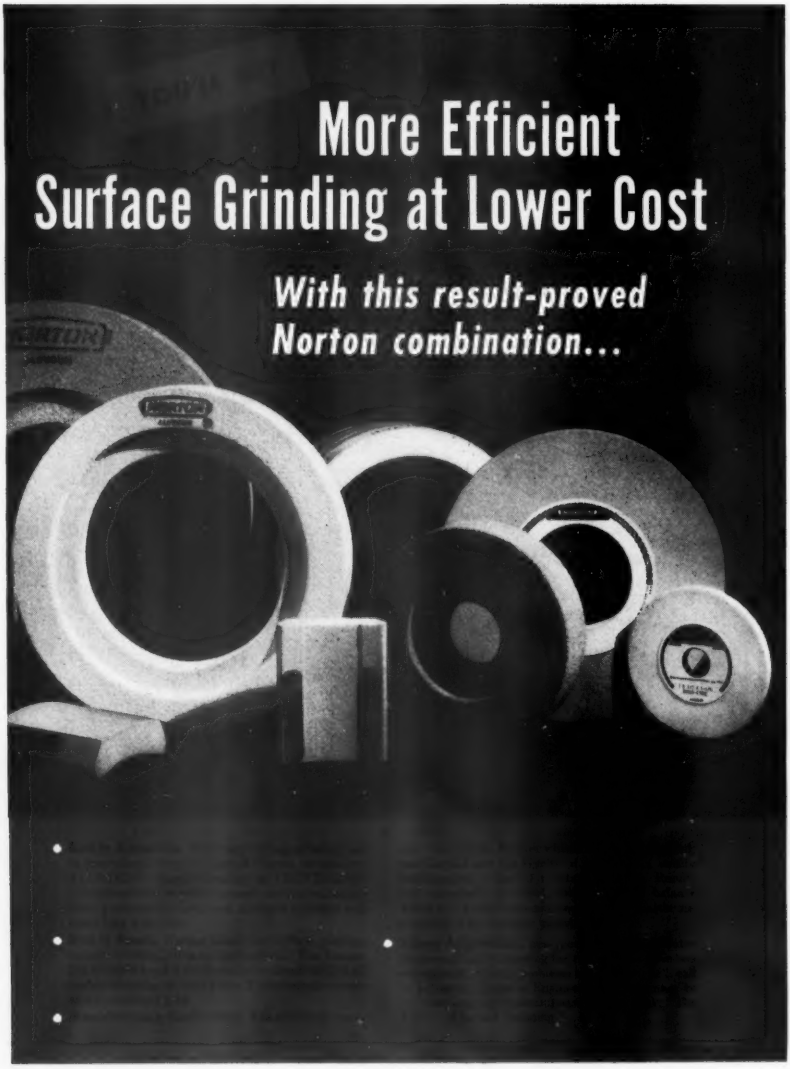
1 Stub Screw Machine Reamers
2 Shell Reamers with Spiral Flutes
3 Jig Borer Precision End Cutting Reamers
4 Hand Reamers with Spiral Flutes
5 Blue Helix Fluted Chucking Reamers
6 Carbide Tipped Fluted Chucking Reamers
7 Expansion Hand Reamers with Spiral Flutes
8 Helical Taper Pin Reamers
9 Camlock Adjustable Chucking Reamers with Serrated Blades

"THERE'S NO BETTER-PAYING INVESTMENT THAN THE RIGHT TOOLS FOR THE JOB"

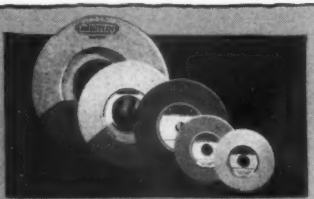
PRATT & WHITNEY

Dedicated to Accuracy for 91 years

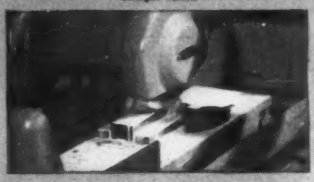
LITERATURE AND INFORMATION MAY BE OBTAINED AT ALL P&W BRANCH OFFICES

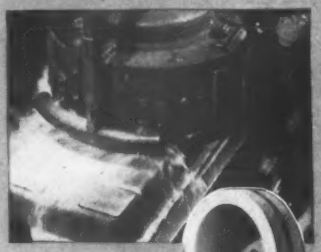

More Efficient
Surface Grinding at Lower Cost
With this result-proved
Norton combination...

With Norton Products—Applied by Norton Experts—You're Sure of Best Results!



Straight Wheels





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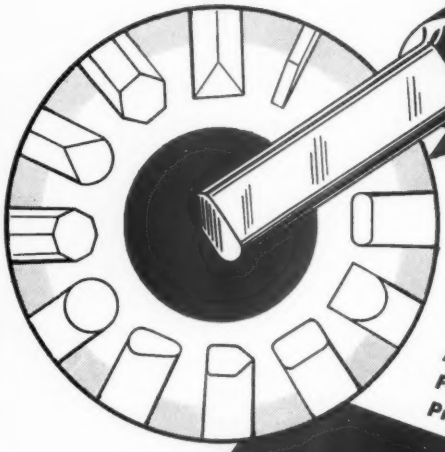

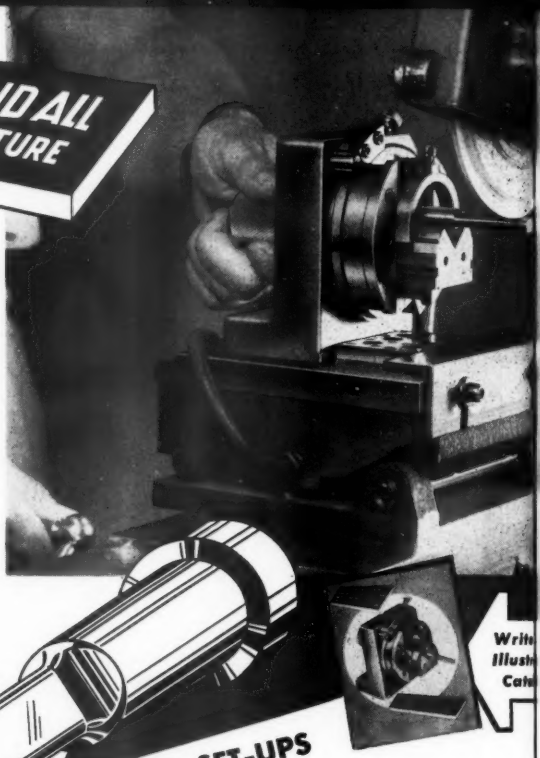

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Hole Location Practices

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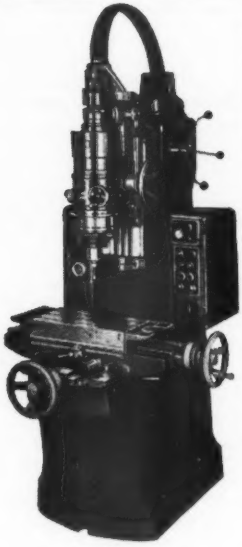

FIG. 1

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Press tools such as lamination and similar dies have various combinations of radii, tangents, angles, and flats, all of which must be accurately ground to size and location. The ordinary lamination die, shown in

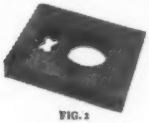

FIG. 2

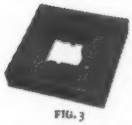

FIG. 3

Fig. 2, is an excellent example. The two-station section was ground complete with proper draft in only 25 hours. Previous time, including filing, stoning and template work, was 80 hours.

Every contour and surface was also checked in the Jig Grinder by coordinate measurement with the lead screws, an important feature of Moore Jig Grinders and Jig Borers.

The right side of the blank die (Fig. 3) was ground with the regular grinding head. The corners, slots and projections on the remaining three sides were done with the new slot-grinding attachment (Fig. 4). Proper draft (including corners) was ground around the entire contour with the taper-setting attachment.

Ask for a free reprint of an eight-page article on the design of the No. 2 Moore Jig Grinder which appeared recently in MACHINE DESIGN.

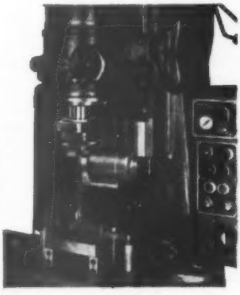

FIG. 4

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"Work Handling at the Press," by John E. Hyler 48
This is the first of a two-part article which is an exhaustive and detailed account of the various ways and means for feeding stock to the stamping or forming press and for unloading the workpieces from the press.

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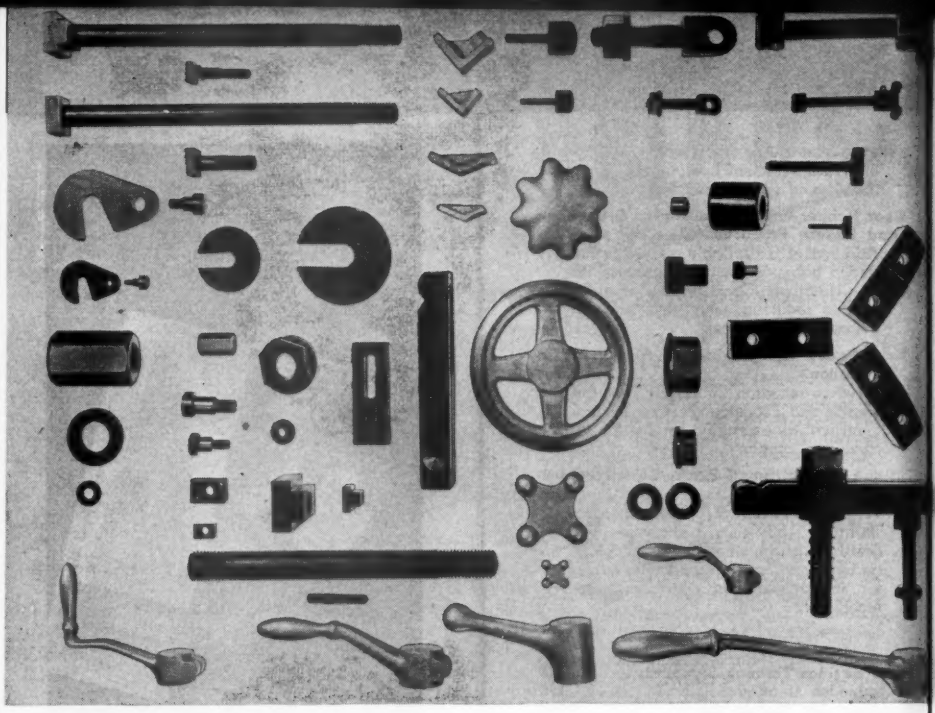

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editorial

the pendulum swings

Among the outstanding trends and accomplishments of the first half of this twentieth century has been the tremendous increase in the human-relations-consciousness of business.

We are speaking of business in the broad sense that it is the dynamic modus operandi whereby the enterprise and initiative of individuals, singly or in groups, large or small, are converted into building, buying, selling and distributing. It is what keeps this country ticking and it is what foots the bills (including tax bills) for the highest standard of living ever attained by a people.

The human-relations-consciousness of business is no longer in the realm of academic debate but has been reduced to daily, matter-of-fact, operating principles and practices which are as tangible as a profit and loss statement.

Under the heading of human relations can be grouped business relations, public relations and personnel relations. Business relations: one business as related to another; public relations: the relation of business to consumers and investors; and personnel relations: the relation of business to its employees.

All of these relationships, over the years, have attained higher and higher planes of conduct, ethics, and human sensitivities and responsibilities. Typifying these relationships are the constructive and mutually beneficial functions of trade associations, progress toward technical standardization, institutional advertising stressing service and quality, foundations established for and appropriations made for research and for education, the humanizing of stockholders reports, retirement plans and hospitalization and insurance, educational exhibits, incentive and profit-sharing plans, to mention but a few. Management and labor now sit down at the conference table in an atmosphere of mutual respect and understanding.

It all adds up to a solid foundation upon which to build an even better future. Business has attained these goals in spite of a continual background of sniping and harassment from government. The bigger the business, the sharper the sniping; this in spite of the fact that the bigger the business, the greater its taxpaying support of government.

Now to wield our yardsticks of human relations and ethics on government, what do we find of 1952?

A very sorry spectacle, a bitter brew that outsmells anything that has ever emanated from Washington. The daily flood of news dispatches gives a kaleidoscopic picture of little men in high places, of machine politics where the pal is more important than the taxpayer, of investigators who need investigating, violations of public trust which aren't violations unless they're disclosed, right hands not knowing what left hands are doing, part time jobs and commissions there-on diametrically opposed to the taxpayers' interest. Again but a few items from a growing list.

Government must put its house in order. The integrity of our government should be a sacred bulwark between our free democracy and the enslaved millions under communism. The stable cleaning job is a colossal one, too much for any one man or entrenched or organized group.

It's up to us, the 1952 electorate. The power is in our hands. If we don't wield it, we will deserve what we get.

E. Willard Pennington.

editor

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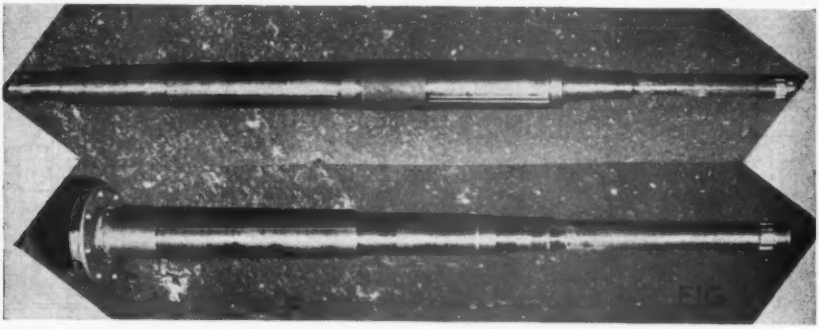
PIONEERS IN THE ART OF DESIGNING AND PRODUCING CARBIDE TOOLS

Fig. 1. Motor generator shaft with exciter extension welded on and an engine-driven shaft with welded flange typical of Lincoln production. Marked savings in steel and in machining operations are realized.



How Lincoln Electric Saves 25 lbs. of Steel per Armature Shaft

Welded Shaft Extension—Clever Die Design—Rolled Serrations—Automatic Welding—Built-up Metal—All Contribute to 40 per cent Cost Reduction.

by Herbert Chase, M.E.
Forest Hills, New York

If anybody has concluded that nothing can be done to lower the manufacturing cost of sizable armature shafts, he may well consider how good planning and the application of modern methods are yielding big savings for The Lincoln Electric Company. Although the shafts in question are for welding generators, they are similar to uncounted shafts used in other electric and nonelectric equipment. If similar methods are applied elsewhere, comparable economies can be realized, even in moderate lot manufacturing, such as applies in instances here cited.

The shafts shown in Figure 1 are typical of those on which the economies described are realized. The longer shaft is used in a motor generator welder unit and the shorter in an engine driven generator welder.

Both shafts are made from SAE 1020 steel bar stock of 3⅛″ and 2⅛″ diameters, respectively. Greater savings result with the longer shaft but those on the flanged one are considerable. They are made in several sizes but those chosen for this description are typical. In neither case were the design changes extensive or of major importance in the economies realized. Chief gains were in the revised fabricating method and in the reduced steel requirements.

Method changes were introduced into an old production line despite congested conditions that will be eliminated when the setup is moved to a new plant now nearing completion. All changes are of a type that can be realized in any production plant engaged in making similar parts. New equipment introduced is not expensive and requires little extra space. In the case of the long shaft, roughing machines can now be used to capacity (which was not true previously) because the shaft is turned before the slender extension is welded on. When the shaft was fabricated from an integral piece of steel, it was so long that it would be deflected excessively under heavy cuts. In addition, to make the slender integral extension an extra 25 pounds of metal had to be converted into chips, since the starting diameter of the stock is 3⅛″. This

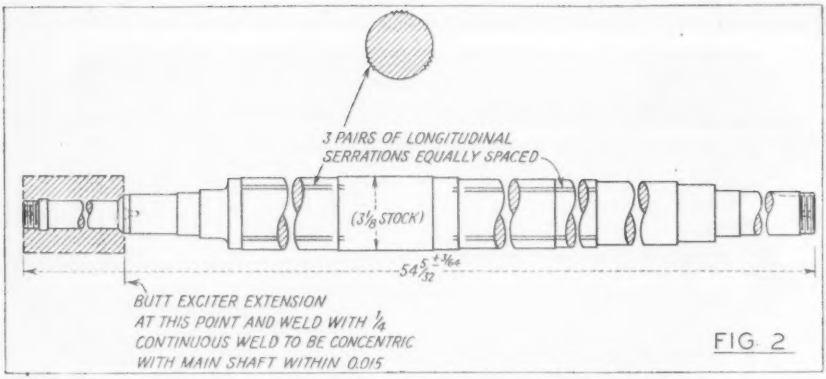

3 PAIRS OF LONGITUDINAL
SERRATIONS EQUALLY SPACED
(3 1/8 STOCK)
54 5/32 ± 1/64
BUTT EXCITER EXTENSION
AT THIS POINT AND WELD WITH 1/4
CONTINUOUS WELD TO BE CONCENTRIC
WITH MAIN SHAFT WITHIN 0.015
FIG. 2

Fig. 2. Drawing of the longer shaft with the exciter extension welded on. A large saving in steel results and machining time is significantly reduced. Cross-hatching indicates how much metal was saved by welding on the extension.

took extra time and involved a large waste of steel now avoided.

When machined without the extension, the shaft is more rigid and the roughing cuts can be made to full depth and at quite high speed. This makes for faster machining although, for the length involved, the total depth and length of cuts are the same as formerly. An extra machine is needed for the short extension, but the work on this is simple and automatic, and costs only a small fraction of the savings realized on other operations.

Production starts with cutting the bar stock to length in a Motch & Merryweather cut off machine. These workpieces then go to a Sundstrand centering machine for center drilling. One man tends the cut off and centering machines, and has time also to tend three hacksaws for other work.

After centering, the shafts go to two Lo-Swing lathes, both tended by one man. One rough turns half the length, producing the steps shown in the drawing, Figure 2. The tooling setup is shown in Figure 3. In the second Lo-Swing, the remainder of the shaft is roughed, Figure 4. In both cases the front tools, all of which have carbide bits, turn the diameters to depth and the rear HSS tools face the shoulders.

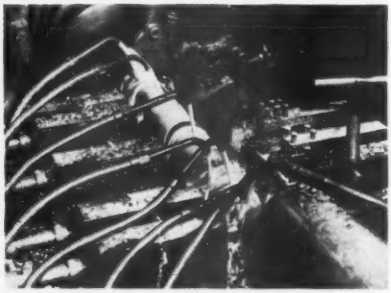


Fig. 3. Setup for rough turning one end of a shaft in a Lo-Swing lathe before the extension is welded on. Heavier cuts permit using the machine to full capacity. When an integral extension was used, lighter cuts were necessary.

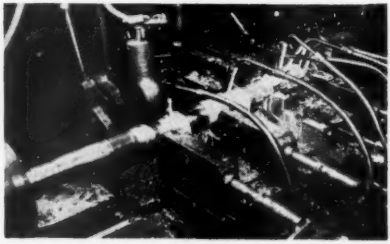


Fig. 4. Second Lo-Swing setup in which the second end of the shaft is rapidly roughed. Carbide tools all cut to full depth in a single pass.

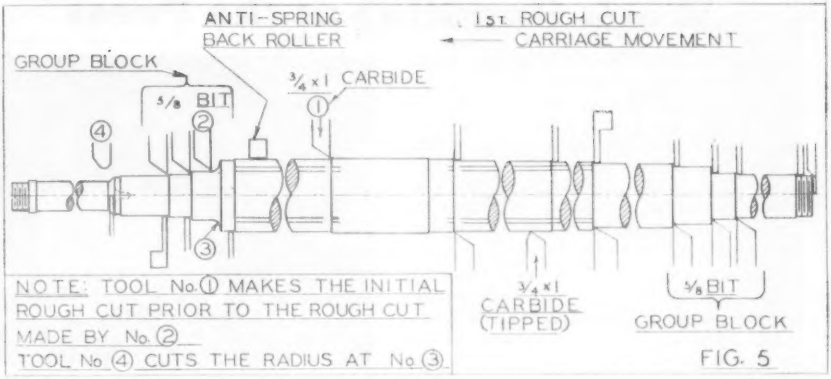

ANTI-SPRING BACK ROLLER
1ST. ROUGH CUT
CARRIAGE MOVEMENT
GROUP BLOCK
3/4 x 1 CARBIDE
5/8 BIT
NOTE: TOOL No. ① MAKES THE INITIAL ROUGH CUT PRIOR TO THE ROUGH CUT MADE BY No. ②
TOOL No. ④ CUTS THE RADIUS AT No. ③
3/4 x 1 CARBIDE (TIPPED)
5/8 BIT GROUP BLOCK
FIG. 5

Figure 5. Drawing showing the type and arrangement of tools for roughing the shaft in lathe operations before the extension is welded on. Some negative rake bits are used and all turning is done with carbide bits.

The turning feed is 0.018" per rev. and the speed is 325 rpm. This loads the machines to capacity (40 hp). Tool layout and details of their grinding are shown in the drawing, Figure 5. Some tools are ground with negative rake.

Although the Lo-Swing operations are termed "roughing," the finish is not important, since some surfaces require no finishing cuts. These operations reduce machine time over former setups by about 20 min. per piece or about 60 per cent, thus effecting a substantial machine operation saving in addition to material savings already referred to above.

The shafts go next to a Norton grinder and are loaded on centers for the finish grinding of two bearing diameters and one steady rest diameter. This latter is ground first and used when the bearing surfaces are ground. All grinds are made in plunge cuts, the shaft being reversed end for end between the two bearing grinds, hence the wheel is not traversed longitudinally. Tolerances held on all ground surfaces are ±0.00015".

All finish turning operations are performed in a 16-inch Monarch lathe with the work turning at 1500 rpm and tool feed 0.010" per rev. Bits are all carbide and some have negative rake. They remove 0.040" to 0.060" of metal. Because of the shorter shaft, these operations require 5 min. less time than formerly, a reduction of 40 per cent.

While turning proceeds, the lathe operator has time to serrate the shaft previously turned, using the special machine shown in Figure 6. Serrating is done with a set of three rollers, each of which has two ridges. The rollers are of 2½" diameter and each turns on a horizontal pin supported in a fixture. The three fixtures are mounted on a plate which in turn is gripped in the jaws of a lathe chuck placed in a horizontal position on the bed of the machine. The chuck does not rotate and is used only because it provides universal concentric adjustment.

In this machine the shaft is held vertically on centers and is fed downward between the rollers as they roll the serrations. Serrations are held within 0.025" and 0.007" above the cylindrical shaft surface and have the shape shown in the drawing, Figure 2. After being pressed down between the rollers, the shaft is elevated on the return stroke and is ready for unloading. Total operator time for this operation is only six seconds. This is far faster than milling a keyway, yet the serrations will hold the lamination stacks, when they are pressed on the shaft, as firmly as a key would hold them.

Serrating nearly completes the major

(Continued on page 50)

Work Handling at the Press

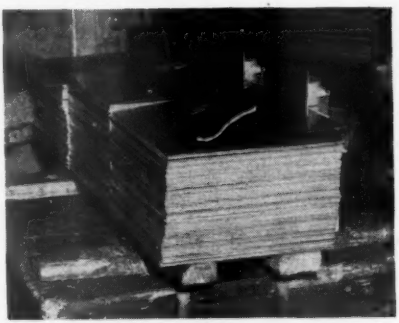
Close consideration of handling materials in various press operations is important from the standpoint of production; also from the viewpoint of safety. The safest and most efficient handling of materials to a press, counting of the number of units worked, and most efficient handling of workpieces and scrap from the press, is a subject to which any production man may well give much attention.

Touching safety, there is no question that hand and finger injuries at presses are a large part of the sum total of industrial injuries. While mechanical guards should be employed and used for all they are worth, no press operator should ever be taught to place full confidence in such guards. Rather, he should definitely be taught never to place his hands in the die. By one means or another, it will be possible to find some handling and working method making it unnecessary for him to do so, regardless of production rate or size of the operation.

If it is felt that circumstances will not allow making much of an investment in reference to safe handling, so simple a thing as a pair of ordinary safety tongs may be employed for placing parts into the press, and for removing them. Some of these tongs have incorporated springs which normally hold the jaws open to receive parts. Thus a part is held only when a grip is being exerted on the tongs. Some of these tongs have short jaws, designed for handling relatively small flat parts. Other tongs may be obtained which have longer jaws. These jaws may be heated and reshaped, as occasion demands, to suit the particular type of material or parts being handled.

Magnetic Separators

Men whose duties involve separation of oily steel sheets when feeding them to presses of different types do not need to be told how tenaciously such sheets often adhere to one another, and how difficult their feeding is under ordinary circumstances. However, this problem has been effectively solved. A number of manufacturers are now employing a so-called magnetic sheet floater for separating a stack of sheets. The magnetic sheet floater is a completely self-contained unit, which requires no electrical or air connections for operation. It employs the fundamental principle that similar magnetic poles repel one another.



One of the latest developments for handling sheet stock is the magnetic sheet floater or separator. The magnetic repelling force acting between the sheet ends causes the top few to fan apart.

Powerful magnets are mounted on a stainless steel bracket and wear plate for convenient use. They induce a magnetic field in the stacked steel sheets adjacent to them. As this magnetic field is created the sheets tend to repel each other. This causes the ends of them to float or fan out with air space between them, making it a simple matter to easily grasp and feed the top sheet. At least three advantages are realized.

Different Types of Workpieces

First, feeding is speeded up. Second, there is little danger of damage to dies as a result of feeding more than one sheet at a time, as has otherwise occurred in various instances. Third, danger of cuts and injuries to hands of workers is reduced to a minimum. Either small-area or large-sized sheets of steel may be successfully separated in this manner for feeding at the press. While the device is used

by **John E. Hyler**

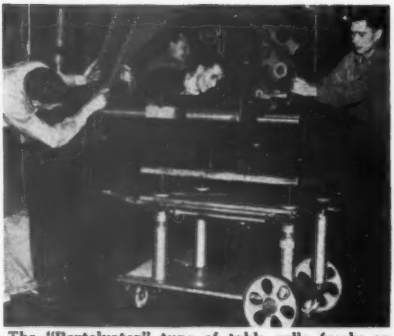
chiefly on rectangular sheets, it is nevertheless employed for separating round blanks also, and most odd shapes can be successfully separated and handled in this manner. As fast as sheets are removed from the top of the stack, others fan out below them.

Ball Transfers

There are some cases in which handling of large sheets or plates into presses or similar machines involves handling plates singly from a rather remote source, rather than handling stacked sheets. One very fine method of handling sheets over such a horizontal span at correct working height consists in use of ball transfers in multiple, mounted on suitable standards. Steel plates, in particular, may be manipulated to high advantage around presses where ball transfers are arranged in this manner. In some cases, too, ball transfers are used to great advantage in beds of presses. The basic design of a ball transfer is that of a large-diameter, hardened steel ball, held and rotated on a bed of smaller balls, the smaller balls being contained in a self-cleaning cup-shaped steel base.

Vacuum Cup Feeding

For handling small flat parts into and out of press dies manually, vacuum cup devices have grown strongly in favor. Some of them have their vacuum cups made of Neoprene, because it is highly resistant to oil. Such cups have a long life regardless of oily surfaces. Pressure on the device causes the vacuum cup to take hold of the material strongly. There is a convenient plunger, which, when pressed by the thumb, disengages the cup from the work. These devices keep hands of an operator completely out of the danger zone, and are available in different sizes for handling different sizes of work.

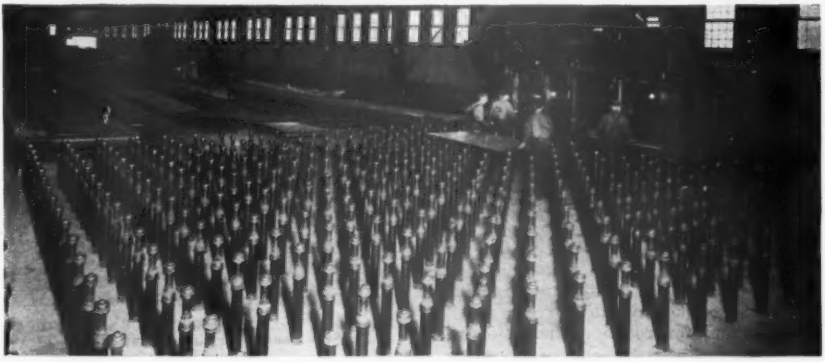


The "Portelvator" type of table rolls freely and can be elevated to suit the job at hand. It permits the easy handling and assembling of upper and lower die set members.

Other highly efficient vacuum cup press feeders have an automatic release in the form of a lever extending out over the handle. This lever is normally held away from the handle by means of an interposed spring. A mere touch of the finger, depressing this lever, will release the cup

(Continued on page 66)

This photo shows how sheets and plates are handled on ball transfers to machines at proper working height. Each upright is topped by a freely rotating ball and the uprights are so spaced as to give the workmen easy access to material and press. After a blanking or shallow forming operation, many such workpieces lend themselves to being loaded from the press and moved by ball transfer.



. . . Lincoln Electric, from page 47

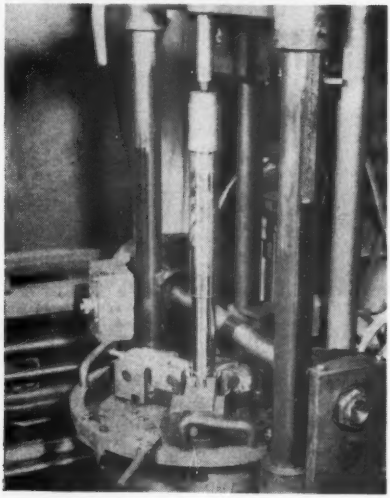


Fig. 6. Special machine employed to serrate the shaft and thereby avoid milling a keyway. The shaft, mounted vertically on centers, is forced downward between three rollers mounted on a plate which in turn is clamped in a three-jaw chuck.

portion of the shaft, but it still has to be joined to the extension produced in other setups. In the size here considered, the extension shown in Figure 7 is 10½" long and 1⅛" in diameter and is machined in a Warner & Swasey automatic chucker that chamfers one end (to facilitate positioning and welding), turns a thread and drills a center.

Four spline-like lobes, shown clearly in Figure 7, are produced by striking the shaft end in a coining die, Figures 7A, 7B and 7C, that indents the metal at four points and forces some of the metal to flow outward to form lobes above the base diameter. The four lobes are then turned to a required diameter in a chucking machine. Work done in the chucker is rapid and ties up this machine for only short periods, leaving it free for many other jobs.

Assembly of the extension to the shaft is performed in the setup shown in Figure 8. The machine is merely one for holding the two components in correct relative position and for rotating them slowly as the arc weld is made. The lower component rests on a center and is held vertically by clamping between v-jaws. Since the lower end of the extension is chamfered to a point that fits into the upper center of the main component, as shown in Figure 7, the chamfered end is self-centering. Then the extension is clamped so as to be in line with the lower component and to rotate with it as the weld is made. Before the parts are clamped in place, a conical cup, having a hole at the bottom, Figure 8, is placed over the shaft to hold the flux with which the arc is completely covered.

Welding is done with a Manual Lincoln-weld unit (sometimes referred to as "squirt" welder) using a high-density hidden arc welding process. Four hundred amperes are applied to the $\frac{5}{64}$" electrode that is fed automatically to the work. In making the weld, shown completed in Figure 9, the electrode approaches the work at an angle of about 60 degrees to the vertical. As soon as the arc is struck, the machine starts to rotate (at the rate of 7 rpm for a shaft extension of 1⅛" diameter) and continues for two complete revolutions.

This results, of course, in a two-pass weld, the production of the outer pass annealing the inner one. The high current density of the process creates a deeply penetrating arc and the weld is uniformly

Fig. 7. At right, extension before welding to the end of the shaft that appears at left.

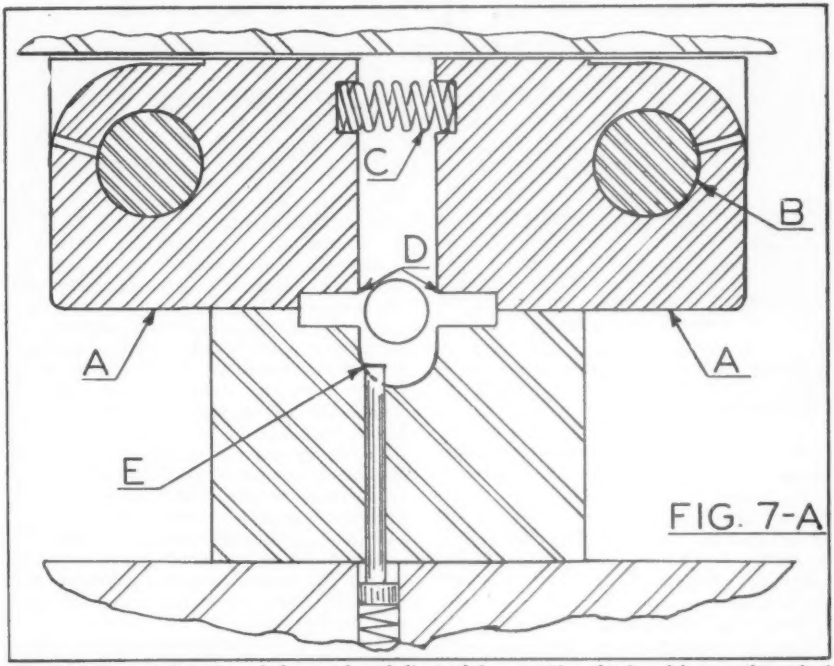


Fig. 7A. Cross-section view of the punch and die used for upsetting the four lobes on the end of the exciter shaft extension. The view shows the die in the closed position at the bottom of the ram down stroke. As the ram ascends, the two sections of the punch A are forced to rotate on the pins B and by the spring C, so that at the top of the upstroke the two surfaces D of the punch have turned inward. As the ram descends and the surfaces D strike the shaft extension, they again rotate on pins B, but in the opposite direction. This rotating action of the punch sections causes indentations to be made in the shaft. The metal displaced by this action flows outward and forms lobes above the shaft surface. Two lobes are formed with each stroke of the ram. The part is indexed with the stop E used to position the shaft for the forming of the second pair of two lobes.

dense, strong and ductile. The two-pass weld results in good penetrations yet provides sufficient build-up for machining. At the end of two revolutions, current is shut off and the shaft is ready for unloading. Complete cycle time, including loading and unloading, is about 2½ min. per piece. Before the workpiece is removed, a suction hose is used to draw off excess flux from the conical cup. Actually this setup gives the benefits of automatic hidden arc welding, yet the equipment is sufficiently flexible to permit installation right on the shaft production line, no welding booth being needed, as the arc is submerged in the flux.

Because the setup is automatic, the operator has time to start other welding (on a flanged shaft) while the welding of the shaft extension proceeds. When the shaft has been removed and cools, it is delivered to the setup shown in Figure 10, where the shaft is placed between centers (one of which is spring mounted) and is straightened by a five-ton Denison hydraulic press. In this setup, the shaft is supported near its center on the ground steady rest diameter. A dial indicator on the ground bearing nearest the shaft extension indicates runout and this has to be below 0.002" total indicator reading to

(Continued on page 60)

Statistical Quality Control at The Universal Wire Spring Co.

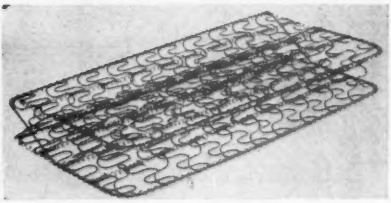
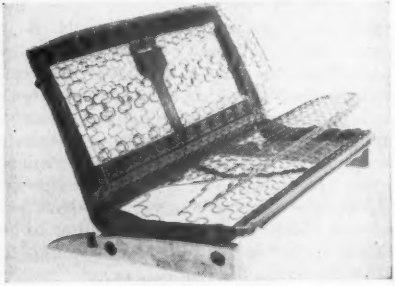


Fig. 1. A zig zag seat spring unit completely assembled. This is typical of the Universal Wire Spring Company's production of zig zag seat springs for the automotive, furniture and aircraft industries.

Before starting to describe the applications of Statistical Quality Control to the products of The Universal Wire Spring Company it will probably be well to tell you a little something about their products so that you can better understand the inspection problems encountered.

Primarily, The Universal Wire Spring Company manufactures zig zag seat springs for the automotive, furniture and aircraft industries. Part of the production for the automotive industry is completely assembled units as illustrated in Figure 1. The rest is individual seat spring components shipped "knocked down" in cartons for assembly at Body Assembly Plants throughout the country. Figure 2 illustrates this type of front seat assembly with the springs mounted on a stamped self-supporting frame.

Fig. 2. An automobile front seat assembly with the springs mounted on a stamped self-supporting frame. This is made up from individual seat spring components shipped "knocked down" in cartons for assembly at auto body plants.



Aircraft seat springs are shipped as assembled units shown in Figure 3 but differ in exact spring form and arrangement to fit the conditions peculiar to aircraft seating. Furniture springs, similar in form to those indicated in Figure 2 are also shipped "knocked down" in cartons for assembly at various customers' plants.

The basic zig zag spring unit made by Universal is a flat or slightly arched strip of corrugated wire which is made in a variety of gauges to meet specific spring rate and load requirements. These flat corrugations are formed or folded into several different shapes to conform to the individual patterns of the completed seat and back springs.

To clarify to some extent the various shapes and forms of wire which comprise zig zag spring assemblies, Figure 4 is a display of all of the different spring and border wire pieces that are used in the assembly previously shown in Figure 2. In the lower center of this picture are views of the flat corrugated wire strips and in the lower left are illustrations of the various folded forms used in the one seat illustrated.

The various forms, notches, bumps and other irregularities in the wires shown are all made on air-forming tools or automatic corrugators, folders and other types of automatic equipment. In forming wire in such a manner several factors contribute to possible variations in the finished piece. These include tensile

by W. H. Neely
President
The Universal Wire Spring Co.
Bedford, Ohio

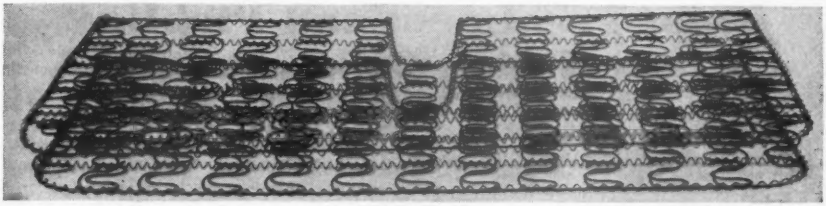


Fig. 3. Aircraft seat springs are shipped as assembled units as shown above but differ in exact spring form and arrangement to fit the conditions peculiar to aircraft seating. Furniture springs, similar in form to those shown in Figure 2, are also shipped "knocked down" in cartons for assembly at customers' plants.

strength, ductility, diameter variation and twist of the wire. Also, variations in machines that produce the parts affect the finished pieces if machine tolerance is not kept within close practical limits.

Since the beginning of wire forming by various methods at Universal, very close inspection has been made on K.D. spring parts before they are packaged. As a result of close inspection throughout the years it has been gratifying that a very high level of quality has been maintained month in and month out with the percentage of rejections in the second decimal place. However, with hundreds of thousands of individual wire pieces being shipped each day it is inevitable that reports of this small percentage of defective pieces reaches Management many days and sometimes many weeks after the pieces have actually been shipped from the plant.

With increasing production in 1950 it was the desire of Management to improve inspection techniques in every way possible so that they could be assured on a daily basis by concise reports that the quality of each day's production was definitely established prior to the time it was shipped to the customer and to keep the number of sub-standard pieces reaching the customer to an irreducible minimum. In other words, Management wanted to lock the barn door before the horse was stolen.

After full consideration of this problem, Statistical Quality Control was determined as one approach which might satisfy the established requirements of uniformity of product quality, more economical inspection and an accurate daily report to Management on product quality. With the assistance of Doctor Berrettoni a system of Statistical Quality Control was initiated at The Universal Wire Spring Company's Plant #2 and its specific application as described in the remainder of this paper relates in particular to the production at this plant.

As mentioned previously the several possible variations in wire characteristics are very important as to their effect

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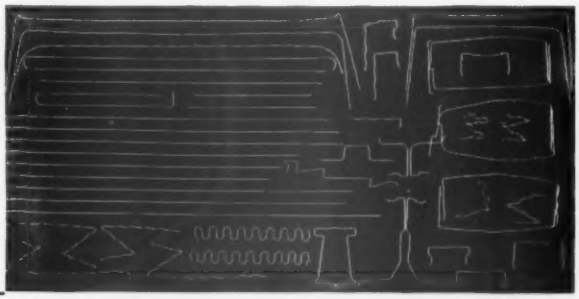


Fig. 4. A display of all the different spring and border wire pieces that are used in the seat assembly shown in Figure 2. At the lower center are the flat corrugated wire strips, and at the lower left the various folded forms used in the seat are illustrated.

Heat Treatment and Pickling of the Stainless Steels (continued)

The Hardening Procedure

In reference to the hardening procedure for the stainless steels, the martensitic group is usually preferred. The hardening of these alloys is accomplished by heating above the critical or transformation temperature, soaking for a predetermined length of time, followed by either air or oil quenching. In the event the lower alloy types are hardened, such as types 410, 403 and 416, both the chromium and the carbon have a marked effect on the "as quenched" hardness of the composition. This can be readily seen in Figure 4.

by **Lester F. Spencer**
Chief Metallurgist
Landers Frary & Clark
New Britain, Conn.

In the case of the high carbon stainless, such as the 440 series, small variations in either carbon or chromium have very little marked effect on the maximum quenched hardness. Hardenability, in the sense that it refers to the lower alloy steels, has relatively little significance with the stainless steels since all of the martensitic stainless compositions harden uniformly throughout the section; this is true even in large sections which are quenched rapidly from above the critical or transformation temperature.

The subject of pre-heating prior to actual hardening may be confusing. For clarification purposes, it can be stated that the lower carbon stainless steels such as types 410, 403, 416, 414 and 431 need no pre-heating unless large or complicated sections are to be hardened, or where materials, such as forgings, are being charged in the hardened condi-

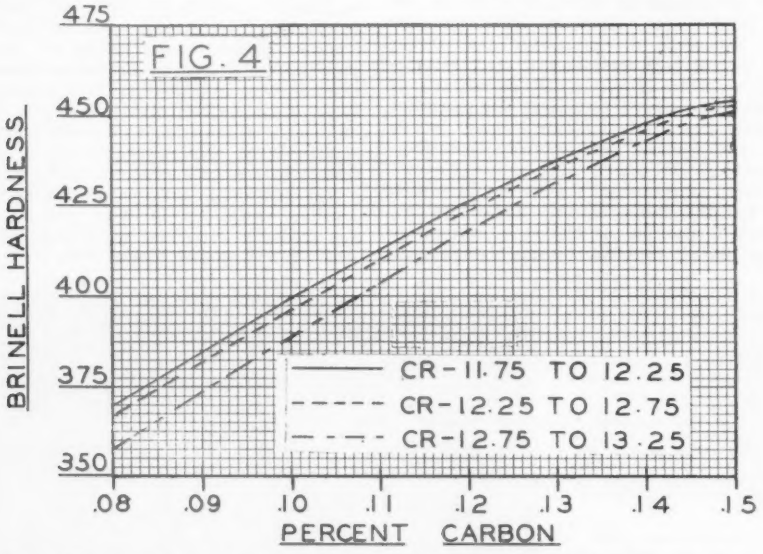
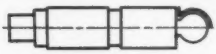
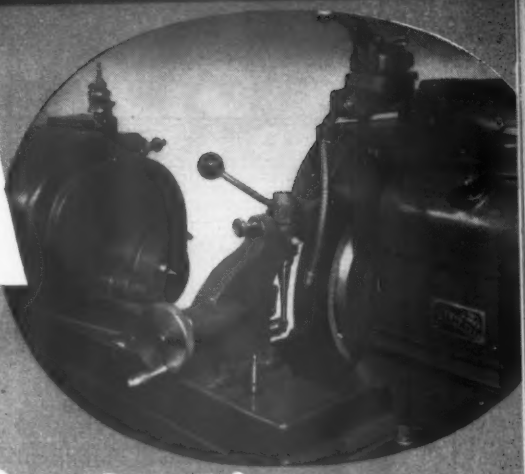


Fig. 4. Showing the effect of both chromium and carbon on the "as quenched" hardness of three stainless steel compositions, i.e., types 410, 403 and 416.



Radius and adjoining face ground simultaneously. This 4" Plain Hydraulic Grinder features a solid table with a short angular section for the headstock, and a combination radius and angular truing attachment.



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In general, the cost of machining operations on small parts should be as small as the part. Two examples of how this goal is attained with CINCINNATI FILMATIC 4" Plain Hydraulic Grinding Machines are illustrated here. You may obtain more data by writing for catalog No. G-551-1.

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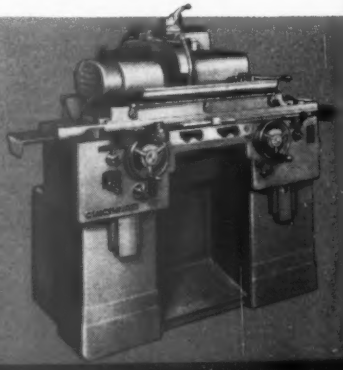

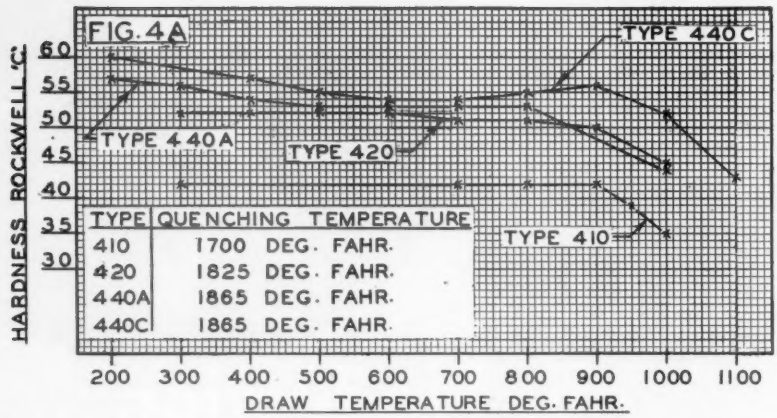

Fig. 4-A. Showing how the hardness range varies with drawing temperature. These curves cover the four types shown along with the respective quenching temperatures at which the tests were conducted.

tion. In such cases, bringing rapidly to full hardening heat may cause thermal stresses[1] sufficient to realize failure.

The higher carbon materials such as the 440 series usually requires a pre-heating operation; small sections may be brought immediately to 1450° F. Larger sections, however, should have an initial pre-heating temperature of approximately 1000° F., and then slowly raised to 1450° F.

The time factor of pre-heating will vary in accordance to the mass, but sufficient time for thorough soaking should be given. After the pre-heat, the parts can be raised quickly to the hardening temperature or transferred to a furnace that is at the hardening heat.

The maximum hardness obtainable on a given section will be dependent upon the hardening temperature selected. Investigation of the "as quenched" hardness of a commercial 410 composition indicates that a temperature range between 1700° and 1800° F. is satisfactory for maximum hardness values. The values obtained by quenching a 13/32" diameter bar are given in Table V. With a 420 composition, a quenching tempera-

(Continued on page 128)

TABLE II. FULL ANNEALING AND PROCESS ANNEALING OF THE MARTENSITIC STAINLESS STEELS (6)

Type A.I.S.I.	Full Annealing Temperature Range, deg. Fahr.	Suggested Rate of Cooling	Process Annealing Temperature Range, deg. Fahr.	Suggested Rate of Cooling
501	1525 to 1600	Controlled	1325 to 1375	Any
502	1525 to 1600	Controlled	1325 to 1375	Any
403	1500 to 1600	Controlled	1200 to 1400	Any
410	1500 to 1650	Controlled	1200 to 1400	Any
414	Not Practical	.....	1200 to 1300	Any
416	1500 to 1650	Controlled	1200 to 1400	Any
420	1550 to 1650	Controlled	1350 to 1450	Any
431	Not Practical	.....	1150 to 1250	Any
440A	1550 to 1650	Controlled	1350 to 1450	Any
440B	1550 to 1650	Controlled	1350 to 1450	Any
440C	1550 to 1650	Controlled	1350 to 1450	Any

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Information Required for . . . . . .

Machine Tool Trouble Shooting

We all know that engineering projects require complete instructions either in the form of specifications or detailed drawings, and in this regard wiring diagrams are instructions to all concerned. Here are recorded the intent of design and the purpose and functioning of the machine in a clear and understandable manner. Yet a designer and fabricator of a machine, having lived with the machine since its inception, sometimes loses sight of the fact that the information he takes for granted and does not record, is of vital necessity to the user of the machine. It is also of vital necessity in the teaching and training that is required to develop operators and maintenance men with higher skills than are now available.

This information is the kind that is in demand, not only during the electrical maintenance of the machine, but for the initial setup after delivery to the user's plant. It permits a user to rapidly familiarize himself with the machine and the part that is usually considered the most mysterious, the electrical control system. Thus it is put into production immediately instead of requiring the verbal instruction of the machine vendor's demonstrator.

Recording of Data Is First Job

At this point, mention should be made that submitting of the wiring diagram and sequence of operations prior to the vendor's starting of work is not within the scope of this paper. However, one fact that we must be aware of is this: The recording of this information is of a vital necessity and must be completed first. When written down accurately, simply, and permanently, reduced cost and earlier delivery dates to both vendor and purchaser are accomplished.

This article is from a talk given by Mr. Bellafaire before the Fourth Annual A.I.E.E. Special Conference on Machine Tools held at Rockford, Illinois, November 1951, which was sponsored by the Machine Tool Subcommittee of the Committee on General Industry Applications of the American Institute of Electrical Engineers. We wish to acknowledge the courtesies and cooperation of Mr. Bellafaire and Mr. B. T. Anderson, Chairman of the A.I.E.E. Subcommittee.

With this in mind, it is the purpose of this paper to acquaint you with the conditions facing production and maintenance personnel and the information that is required for trouble shooting and for the most economical operation of machine tools. The problem is unchanged whether it exists in the manufacturing or processing of automobiles, button holes, clothing, shoes, milk, butter, or candy.

The objection of increased costs and extended delivery dates resulting from the vendor and purchaser collaborating in a complete design and recording of information is more than compensated in the savings in time and money effected.

by **John P. Bellafaire**
Foreman, Design and Scheduling
Plant Engineering Dept.
Chevrolet-Detroit Gear and Axle
Division of General Motors Corporation
Detroit 12, Michigan

In the automotive industry, manufacturing processes require highly coordinated and economically loaded machines to meet the scheduled production. Many of these machines are of special purpose and many are of standard models. Yet to meet the demand of low cost production, they have become complex in nature. Much of the production skill, heretofore under the control of the operator, has been transferred to electrical, hydraulic, pneumatic, and mechanical controls. Upon one of these or a combination of all of them, we have come to depend for control of machines in producing quality and quantity parts.

Instead of the operator furnishing the skill and the mental processing required in the production of a part, these functions are built into the machine so that the operations or processes are repeatedly reproduced with the accuracy demanded by the mass production system. These functions of the operator are built into the machine through the use of motor

(Continued on page 62)

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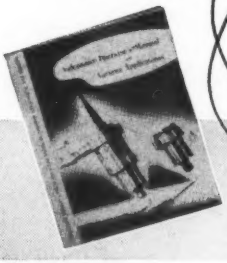
Advantages—10 micro finishes using carbide mills . . . 8 micro finishes using mounted points, operates at any angle . . . air driven, air cooled, overheating prevented . . . speed controlled at optimum point . . . 3⅝" long motor uses little working space . . . By controlling speed at any point you abolish need for many constant speed spindles.



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SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

. . . Lincoln Electric, from page 51
pass inspection.

Completion of long shafts is done in a second 16" Monarch lathe in which one diameter is threaded and the weld is machined to form a 45-degree chamfer. Shafts are then ready for transfer to stock or to assembly lines.

The foregoing descriptions refer primarily to long shafts but most of the same operations are performed on shorter flanged shafts for engine driven units and the same machines are employed in most cases. In fact, the short shafts are identical with the long ones over an equivalent length. Instead of having an AC rotor end, the short shafts receive an engine coupling flange which is machined separately and then is welded in place.

This welding is done in a machine (Figure 11) which is similar to that for welding the extension shaft (Figure 8) except for such changes as are needed to hold the flange and for positioning the shaft with the other end up, so as to bring the weld into the best position. As the weld is of larger diameter, the work is turned at a lower speed (3½ rpm) but the same type of welding equipment is used and the operation is automatic once the setup is made. Cycle time, including loading and unloading, is 1½ min.

Flanges are of 5⅛" diameter and, until recently, were 1¼" thick, Figure 12. This permitted machining an annular step boss on the outer face but involved considerable waste in chips formed. To nearly eliminate this loss, the boss is now produced by depositing weld metal on the flange to

(Continued on page 64)

Fig. 7-B. Three-dimension view of the lower die set member. Coining die A functions with coining punches B (Fig. 7-C) to "pinch out" the shaft metal. Pin C indexes the work for forming the second pair of lobes.

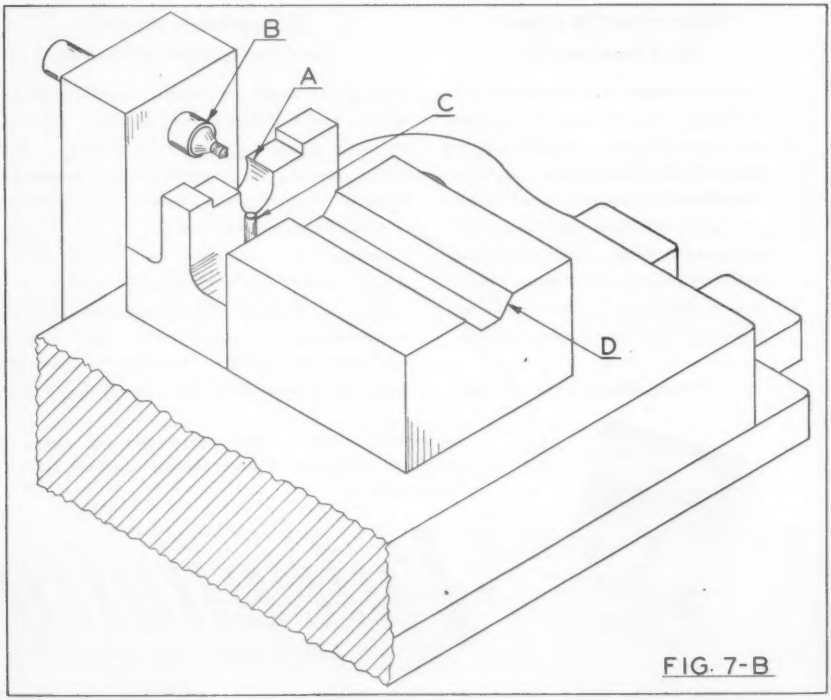

FIG. 7-B

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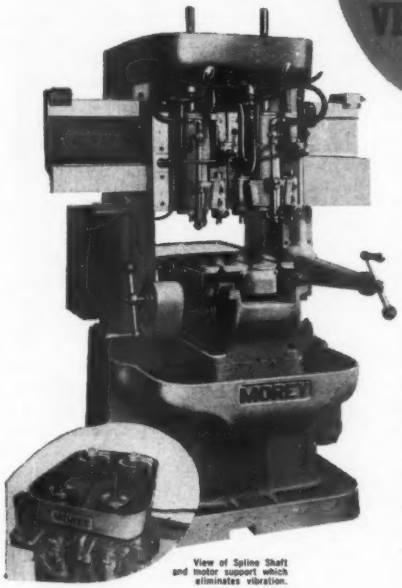

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SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

. . . Trouble Shooting, from page 58
starters, contactors, relays, and solenoids controlling both pneumatic or hydraulic valves, push-buttons, limit-switches, timers, counters and the other control accessories.

As more skills and processes are transferred into the machine from the operator, the more highly complex become the machine controls, and with the modern trend the operator merely loads parts for processing into the machine and sometimes presses a button to initiate the machine cycle.

The Problem of Down Time

Our modern mass production systems have these machines set up to perform one specific operation or several operations at one time. If one of these machines is down, other machines or machines performing the same operation must carry the increased load to maintain the production schedule. When machines are loaded to their rated capacity, this increased load cannot be adequately handled and will eventually result in a delay to production. For a lack of that particular part the sub-assembly or main-assembly process may be affected.

This down time of a machine is costly. A machine is not producing. An operator is idle and soon that machine may cause other machines and operators to become idle. Money invested in a non-productive machine or paid to an idle operator must be absorbed eventually in a higher unit cost of production. Therefore, the necessity of returning the machine and the operator back to production in the minimum of time is apparent and of vital importance.

Whether the maintenance man be an electrician, a foreman, or superintendent, when he receives a call for servicing a machine the race against time begins. The production foreman is vitally concerned as to when he can return the machine back to production and becomes very anxious with the maintenance man. The longer the down time, the more perturbed he becomes, along with those higher levels of supervision which join the group as the delay or down time begins to affect production.

Thus, with the increasing demands for the use of the machine, the maintenance man is faced with the problem of quickly finding the trouble. He must be able to rapidly analyze the trouble. From the description of the erratic condition given to him by the machine operator, job setter, or production foreman, he must relate it to a controlled function of the machine and locate the factors which affect that function.

A limit switch may have failed to operate or a solenoid may have stuck open or burned out. But which limit switch and where it is located is the problem. The delay in correcting the source of trouble is increased when valuable time is spent by the maintenance man in determining the characteristics of the machine.

However, with a complete wiring diagram available at the machine, much time can be saved in determining the source of trouble if it gives the maintenance man the information which will enable him to become rapidly acquainted with the machine control functions.

Complete Wiring Diagram Used

In order to meet the challenge of returning, or placing, the machine into production, the complete wiring diagram has proved in our experience to be most effective in minimizing the down time on a machine. This complete wiring diagram has been developed into a form that contains the electrical schematic diagram, sequence of operation, schematic layout of the machine components such as air and hydraulic equipment associated with the control of the machine, and finally a bill of material. **Hence, all the necessary information is on one sheet.**

We have found that one sheet can be handled more advantageously than several sheets. Instead of paging over the prints, with the complete wiring diagram, the maintenance man can rapidly acquaint himself with the machine as he glances from the schematic diagram to the sequence of operations and to the schematic machine layout. When the information is presented on several sheets, invariably one sheet will be missing at the time when it is needed most. Also, the possibility of distraction in going from one sheet to another is eliminated when the complete diagram is used.

The schematic, elementary or line dia-

(Continued on page 70)

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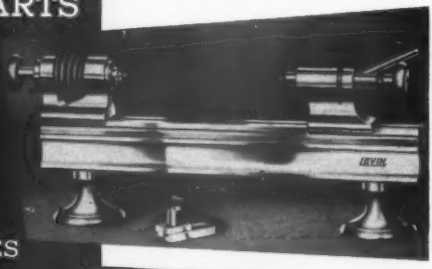

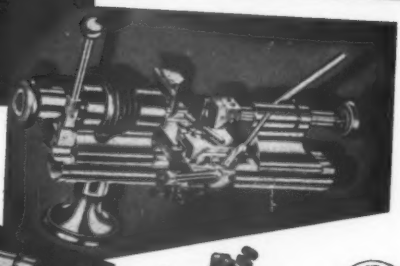

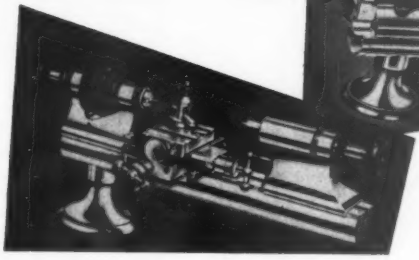

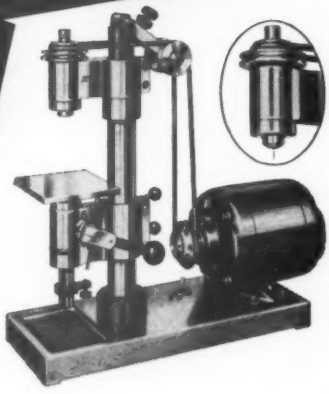

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SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

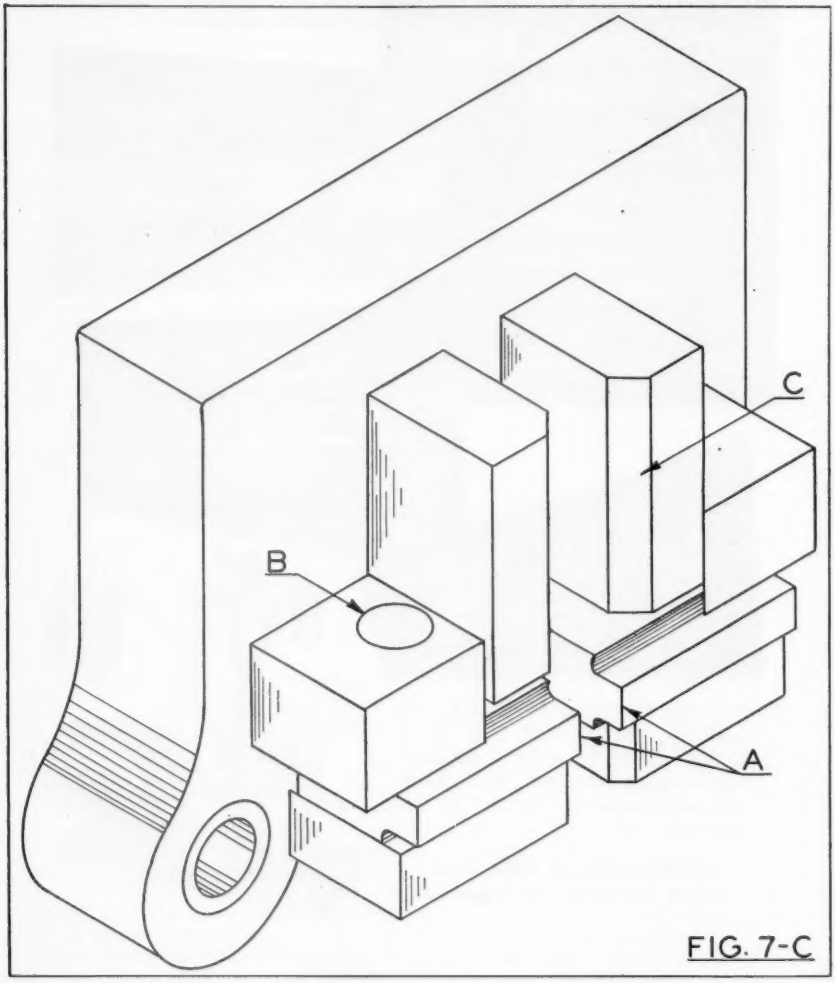
. . . Lincoln Electric, from page 60

the approximate shape of the annulus and then machining to finished size.

Metal for the boss is deposited in the setup shown in Figure 13, which is similar to that in Figure 11, but with the outer face of the flange up. Cycle time in this case is 1¼ min. and the same form of welding equipment is used. Figure 12 shows the shaft flange boss metal as deposited by welding and also as the boss appears after machining. By depositing boss metal by welding, about 1.8 lb. of

(Continued on page 68)

Fig. 7-C. Three-dimension view of the upper die set member. Coining punches A rock on pins B, thus upsetting the shaft metal. V-guide C aligns shaft during the operation.



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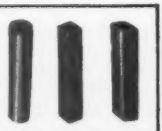

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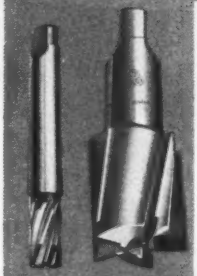
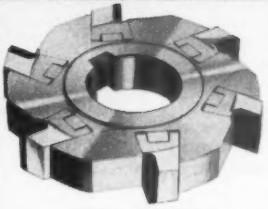


END MILL

COUNTER BORE



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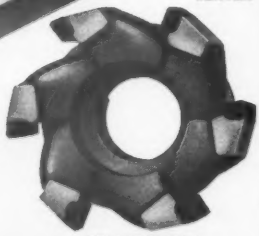
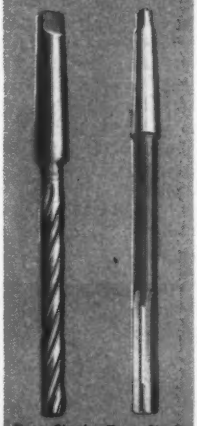


SHELL END MILL



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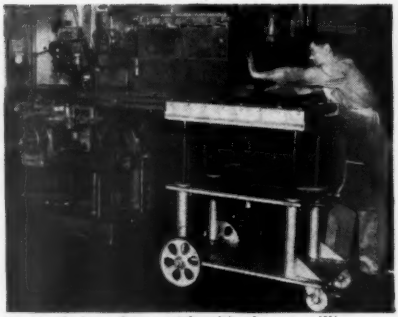
SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

. . . Work Handling, from page 49

from the work. Small and large diameter cups are available for feeding different sizes of work. It is well to have a good selection of sizes, since cost of such devices is nominal.

In operating some of these vacuum cup safety handling devices, one simply grasps the end of the handle firmly and strikes the sheet or blank to be lifted with a smart blow with the open vacuum cup. This action produces a vacuum within the cup, causing it to affix itself firmly to the workpiece. A lever, overhanging the handle proper, is depressed with the thumb when desired to release the work. This action unseats a valve incorporated in the cup, and consequently breaks the vacuum.



As is being done with this large milling machine workpiece, heavy die sets can be eased onto a press bed from the "Portelvator" type of table equipped with an auxiliary top with rollers.

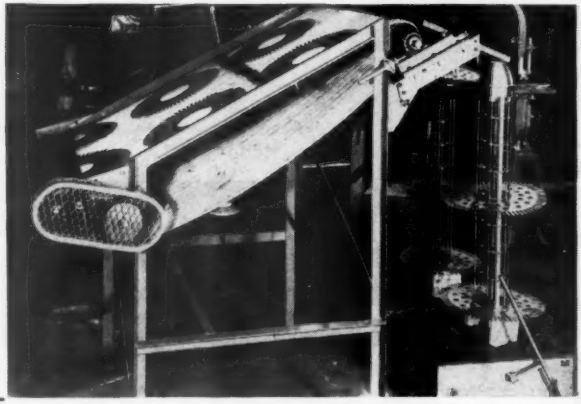
Compressed Air Vacuum Cups

Vacuum cup safety handling devices have also been put into use in various places in which vacuum is secured by using compressed air at about 45 pounds pressure. This makes the handling method still more convenient. In this case, the vacuum cup is connected (by means of a staunch tube) to a pistol grip. Since air is used at about 45 pounds pressure, and the orifice in the device is very small, very little air is used. Safety feeders of this kind may be and are provided with one, two or more vacuum cups, depending on size and weight of work to be lifted. In cases where pieces being handled have a hole in the center, a double-cup safety feeder is employed. This allows work to be properly balanced while each of the cups engages a solid portion.

In using one of these devices, the operator simply places the cup on the work and pulls the trigger. A strong vacuum is immediately established in the cup, and is maintained until the trigger is released. When the trigger is released the piece drops instantly. The basic principle of this device is very similar to that used in industrial steam-actuated injectors, It matters not whether surfaces are wet, dry or oily. Parts may be efficiently handled just the same. Incidentally, exhaust air issues from the tip of this feeder and

(Continued on page 104)

Here are illustrated two special matchers for stamped laminations used in diesel locomotive generator armatures. The conveyor receives the laminations from the press, carries them upward and deposits them onto the noses of the stacking tubes as shown.



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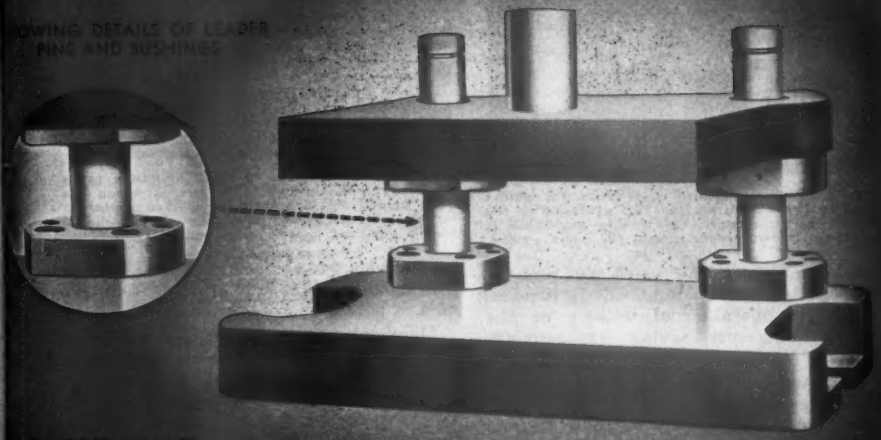


E. A. BAUMBACH MFG. CO...

. . . Lincoln Electric, from page 64

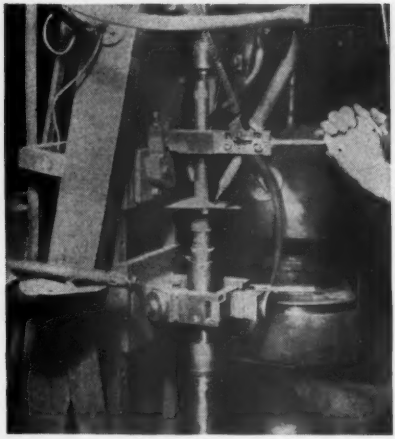


Fig. 8. Special machine and setup for squirt welding (by hidden arc) a shaft extension to the major shaft component. A double weld bead is produced in two revolutions of the parts welded.

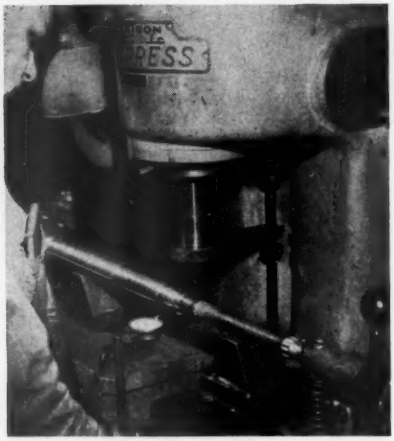


Fig. 10. Setup under a Denison hydraulic press for straightening a shaft after the extension has been welded on. Supports are a fixed center at far end, a steadyrest near the center and a spring mounted center, near end.

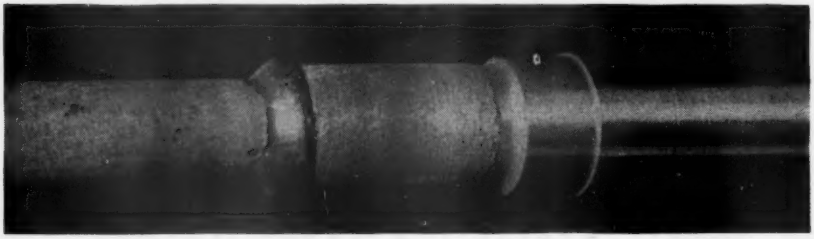
steel are saved and machined time is reduced by about 6 min., but it requires the extra operation of welding on the metal. Net cost saving approximates $3,000 a year or 60 cents a shaft.

If welding were not used to fasten the flange to the shaft, it would be necessary, for economy, to forge the piece and produce the flange by upsetting. This would increase cost and also necessitate a forging die that would be costly. Welding is much more economical and the whole job is done within the plant where there is a minimum of handling, as the welding is done right on the machining line. Labor economy is high, partly because most operators tend two or more machines. Where, previously, the line was operated with six men, it is now operated with three.

Machine equipment is about the same as for the prior jobs but is used more efficiently. The extra chucker for the extension shaft is very fast and is employed for numerous other jobs. Consequently, its use on this job has only slight effect on over-all costs. The welding setups cost little but save significantly, as already indicated. On the long shafts, savings approximate $4.61 per piece and on the flanged shafts, about $3.00 per shaft, according to the Lincoln Cost Reduction Department, which is responsible for the

(Continued on page 120)

Fig. 9. Shaft as it appears after the extension is welded on but before the weld bead is machined.



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gram in showing in simple form how the machine is wired and what the power and control circuits consist of, should be drawn using the standard graphical symbols for electrical devices. Symbol designations other than these can readily confuse the maintenance man. In the schematic line diagram, brief explanations are marked along side of the device symbol to indicate the condition of a control device as related to machine functions. This aids greatly in analyzing the control function.

A limit switch contact symbol with a brief explanation indicating its condition when actuated by or as related to a machine component, has been found to give a fuller understanding of its function in the control circuit. For example, along side of a limit switch contact we might briefly note **"LS-7-no closed-end of spindle forward stroke."**

The range of the pressure settings controlling a pressure switch indicated on the diagram eliminates questions concerning its characteristic or function. Words of description of what solenoids control in the machine cycle when energized, lessen the mystery that sometimes surrounds them. A solenoid symbol with the note **"Sol a—brings clamps forward"** firmly implants the idea of its functions.

Also, inrush and sealed values of current for solenoid operation help in determining erratic conditions of the device. A contactor or relay coil symbol may have a short description of the cycle function that it directly initiates, such as **"returns back-up cylinder."**

Of great importance on the schematic line diagram are the terminal point markings, or numbers, since they assist the maintenance man in making a continuity check or tracing the connections of the devices and locating the source of trouble on the machine.

From the sequence of operations, the maintenance man should be able to learn how the machine is controlled and normally operated. A sequence of operations, of necessity, should be brief, simple, and complete. Not too wordy, yet adequate enough to convey the cycle progression. Lengthy and involved sentences of description have been found to have a tendency to confuse the maintenance man who is working under the strain of returning the machine to production. On the other hand, not enough description has forced him to spend valuable time analyzing the line diagram in greater detail.

Limit-switch actuations, timer functions, push-button operations, should be adequately explained. If pressure-switches are required in the circuit, the settings at which they function, and how the pressure variations are introduced, should be indicated. When selector or drum switches are incorporated, a brief description of how their various settings affect the machine cycle has been found to eliminate guess work as to the functions involved.

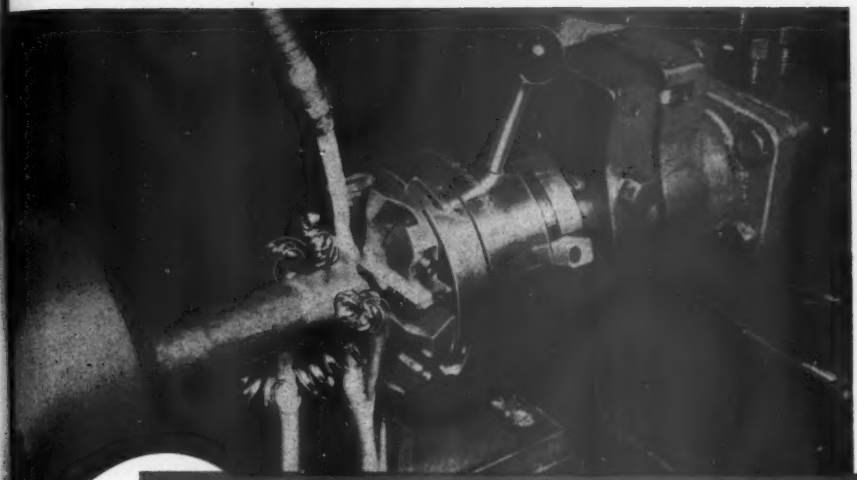
We have found that limit switch and solenoid schedules placed at the bottom of the sequence of operations aid the maintenance man considerably in identifying their function in a very few minutes. A brief description of their action is all that is necessary. This schedule is very useful to the maintenance man who may be familiar with the machine, since by reviewing the list his memory is refreshed as to the various limit switch functions. Thus it helps him to readily localize the trouble. Also, this schedule provides a key to where each limit switch is located on the machine because it briefly explains what part of the machine actuates or operates it.

In hydraulically or pneumatically operated machines a solenoid schedule serves again as a key to the control of the hydraulic or pneumatic movements of the machine, because each solenoid can be identified with a particular machine movement.

Data Should Be Typewritten

A typewritten sequence of operations has proved to be an asset because of its better legibility, and because it doesn't require as much space as the hand printed form — this allows an opportunity for more complete descriptions of the cycle, especially when the sequence was condensed either for the lack of space or for a saving of time on the part of the draftsman in printing a long and detailed sequence of operations.

In the complete wiring diagram we also



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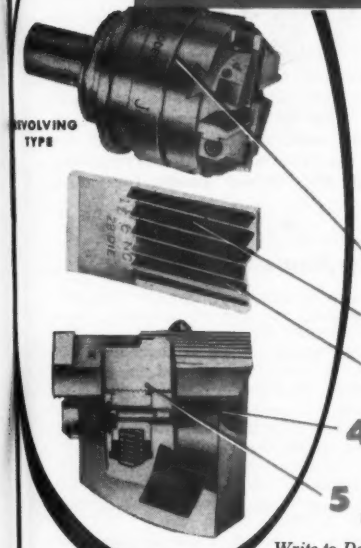

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include a schematic layout of the machine components. Its intent is to show the physical relation of the moving machine parts, such as hydraulic or air operated cylinders, rotary cams, spindle heads, clamping mechanisms, to the control or limit switches which they act upon during the machine cycle.

This helps the maintenance man to clearly visualize where these various control accessories are without searching or climbing all over the machine and continuously consulting the wiring diagram to find where they fit into the control setup. It presents a better picture which enables him to quickly visualize the control scheme of the machine while reviewing the sequence of operations and analyzing the line diagram.

For example: assume that the trouble happened to be that a drill spindle failed to advance. From the schematic machine layout the associated controls are readily checked in the schematic diagram and the sequence of operations or limit-switch and solenoid schedule, proceeding from there to determine which device had failed in its function. Without this layout precious time would be spent by the maintenance man in analyzing the machine part and its associated control.

Another point to consider is that the markings alongside of the limit switch on the machine may not be clear or are covered with dirt; hence its identity would have to be found by its association with a particular machine function in the description of the cycle of operations.

Schematic block diagrams of the solenoid operated, hydraulic or pneumatic equipment shown in relation to the parts they control, assist the maintenance man in understanding the machine cycle.

Finally, to complete the wiring diagram a bill of material is included on the same sheet. Every electrical device used in the machine control should be listed in enough detail to permit its replacement if found defective. The manufacturer's name, type or model, and catalog number are important. To mention one item, contactors or relays should be listed as to their rating and the number of normally open and normally closed contacts.

Another item is to have the control device identified in the bill of material by the same numbers or letters used both in the line diagram and sequence of operations for that device. Oftentimes, when this is omitted, in replacing the device the maintenance man is forced to consult the diagram in order to determine its electrical characteristics.

In conclusion, when the maintenance man has a complete wiring diagram available for servicing a machine, the amount of time required to locate any trouble or to become acquainted with the machine control cycle is reduced to a minimum. A line diagram thoroughly marked with the control device functions, and a sequence of operations, enhanced with a limit-switch and solenoid schedule, when used in conjunction with a schematic machine layout, furnishes the maintenance man with all the information he needs to put the machine into production. Instead of spending minutes, which grow into hours, analyzing or searching for the control setup, in a relatively few minutes he can find the trouble. The maintenance costs on the machine are reduced and with this the unit cost of production will be reduced.

Thus we follow the principle that has made America the leading producer of goods with the highest physical standard of living "and an ever increasing rate of production," and meet the intent of the policy of the General Motors Corporation, of **"More and better goods for more people."**

★ ★ ★

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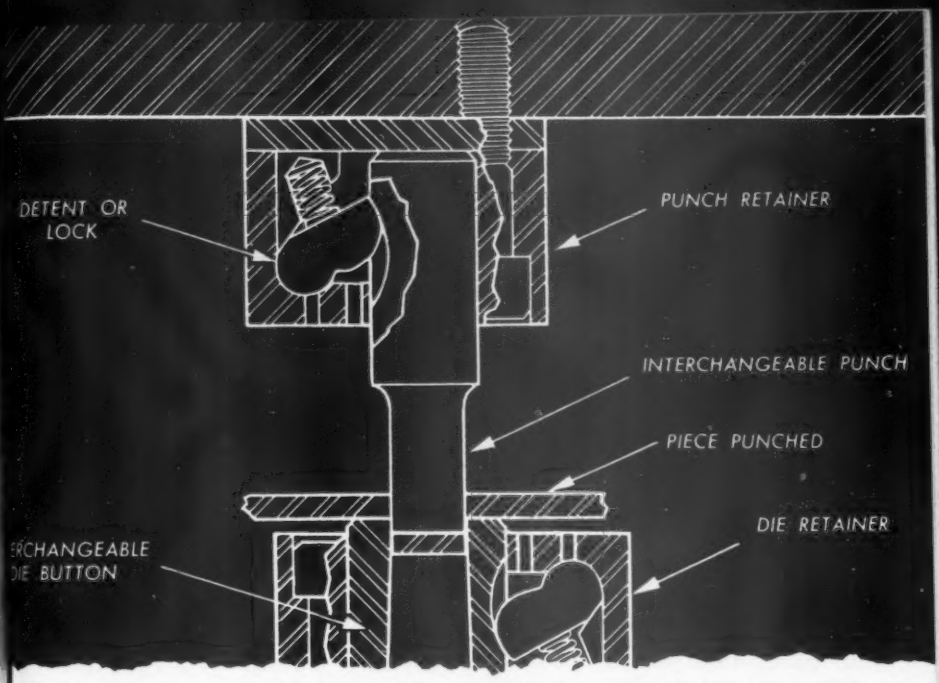
Scully-Jones & Company, Chicago manufacturer of standard and special production tools, has been honored for an outstanding safety record—three years without a disabling accident or an accident that caused the loss of a single day's work.

H. D. Long, company president, and Joseph Kosinski, works manager and chairman of the plant safety committee, received an honorary plaque in recognition of the record from R. E. Dalstrom, midwest safety director for Lumbermens Mutual Casualty Company, a member of the Kemper insurance group.

"You should be proud of the fact that your 400 employees worked a total of 1,334,325 manhours without a single lost-time accident," Mr. Dalstrom said. "The record is especially commendable in these days of critical manpower shortages," he added.



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. . . Quality Control, from page 53

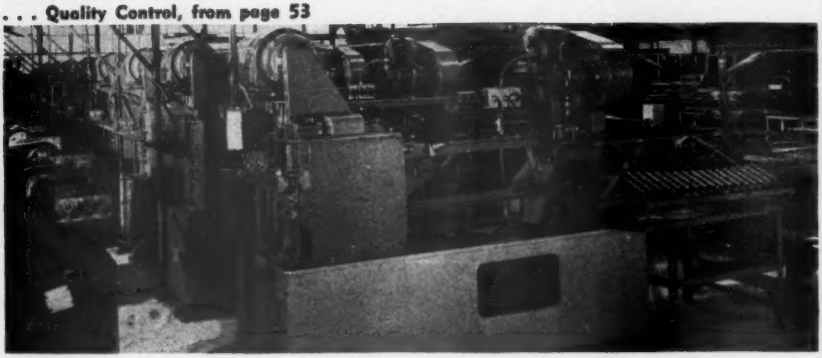

Fig. 5. The principle of statistical quality control was first initiated at the corrugating machines. Each machine is equipped with a synchronized cut-off die and counter arrangement so that the zig zag strips can be cut to any one of the specified lengths for formation of the different spring forms shown earlier. The length of the basic strip, the pitch or bar-to-bar dimension of each loop, and the parallelism of each bar in relation to the others are most important in the formation of the ultimate part.

upon the forming of zig zag springs and the various border wires which go to make up assembled seat springs. It was therefore logical to first establish more efficient quality control at the preliminary stage in the manufacturing process.

Each coil of wire is graded for bending characteristics.

After grading, the coils are segregated so that like grades can be processed through machines adjusted to best performance with a given grade thus minimizing to as great an extent as possible machine adjustment and excessive scrap.

There are no records kept of this preliminary phase of Quality Control, wire grading, except on those coils of wire which are rejected and returned to the supplier because they will not fit into any usable category.

The first step in the manufacture of zig zag springs is a continuous formation of the flat, sinuous zig zag strips. These basic shapes are formed on corrugators, Figure 5, so-called because of the similarity in appearance between the strips and a cross section view of the widely known corrugated sheet metal. Each corruggator is equipped with a synchronized cut-off die and counter arrangement so that the zig zag strips can be cut off to any one of the specified lengths for formation of the different spring forms

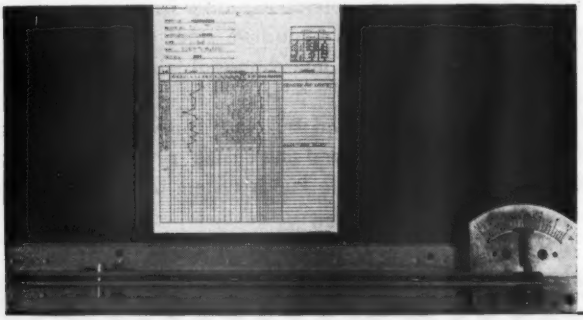

Fig. 6. This gauge was developed to gauge the length of the corrugated strip samples. The pointer at the end indicates the length in plus or minus dimensions. The limits are defined by a shaded area in the central part of the scale.

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shown earlier.

The length of the basic strip, the pitch or bar-to-bar dimension of each loop and the parallelity of each bar in relation to the others is most important in the formation of the ultimate part. Quality Control at this point in the process is of utmost importance. The principle of Statistical Quality Control was first initiated at the corrugators.

Where previously corrugators were adjusted for correct pitch and overall corrugated length after a check of individual pieces, sampling principles based on normal frequency distributions were adopted. Length tolerances were halved for the new type of inspection and the operators were instructed that machine adjustments would only be made if more than two out of five consecutive pieces were outside the length tolerance. The old method of assuming that the machine was out of adjustment if one piece was either too long or too short was misleading because on the basis of one sample taken at random and with consideration for the many variables affecting length, one piece could be too long and the next piece too short, but the average of the two would be within limits. If this were the case, it is obvious that a length adjustment on the machine would not be necessary.

To quickly and accurately gauge the length of the corrugated strip samples, the gauge shown in Figure 6 was developed, the pointer at the end indicating the length in plus or minus dimensions. The limits are indicated by a shaded area in the central part of the scale.

A method of taking five consecutive samples to determine the length of the corrugated strip coming off the machine makes it possible for the inspector to record the results of his sampling and measurements on the chart also shown in Figure 6. This is a typical "—X" and "R" chart. The length of each of the five pieces in the sample is termed an "—X" value and recorded on the chart. These values are then averaged and the average is called "—X" (X Bar). The average "—X" is then plotted on the chart. The "R" on the chart indicates the range in

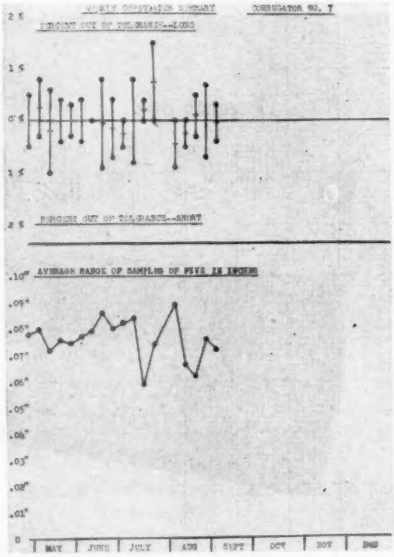

Fig. 7. This continuous summary chart for each corrugating machine is prepared on a weekly basis. From this, Management can make quality comparisons of machines and operators, and can also evaluate each machine as to its ability to make parts within tolerance.

length deviation and is obtained by subtracting the shortest length from the longest. This "R" value is also plotted on the chart.

The deviation limits of the "—X" values from zero are established for each specific length of corrugation and as long as the "—X" values are within these limits the machine will be producing parts within tolerance. Also the "—X" chart indicates whether the operator is keeping his machine adjustment properly zeroed. The "R" values indicate whether the machine and wire conditions are such that five pieces in a row can be produced within tolerances.

A continuous summary chart for each corrugating machine is prepared on a weekly basis, Figure 7. From this Management can make quality comparisons from each machine and operator, and also evaluate each machine as to its ability to make parts within tolerances. This

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Fig. 8. This scoreboard hangs in the Corrugator Department. The average value for each corrugator is posted on the board after each time the inspector has made his round. Posting these values for each machine creates a competitive interest among the operators and an incentive for each man to excel. Since the scoreboard was instituted there has been a continued improvement in the appearance of the charts, reflecting more consistent quality than ever before experienced.

system of quality control at the corrugators has resulted in a marked reduction in rejected pieces from the machines because of incorrect lengths as illustrated by a specific example of one piece which requires no further forming after leaving the corrugators. During one period in 1950 we had 1594 of these pieces rejected for length while during the same period this year we had only 13 rejected.

Figure 8 shows the scoreboard we have hanging in the Corrugator Department. The average of "—X" value for each corrugator is posted on this board after each time the inspector has made his round. by posting these "—X" values for each machine (which reflects the type of product coming from the machine) we create a competitive interest among the corrugator operators and thus supply an incentive for each man to excel. Since this scoreboard was instituted there has been a continued improvement in the appearance of the "—X" charts which reflects more consistent quality than ever experienced before.

For the back spring assemblies, corrugations made from 12-gauge wire are used. Some of these corrugations require no further processing except heat treatment before they are ready for shipment. Others, after an initial heat treatment, are dispatched to the back folding machines where they are formed into various shapes required in the assembly ("M" shapes and "Z" shapes).

Here again this operation is effected by the variations in wire characteristics, machine tolerances, and the length of the flat corrugated strip. Quality control must be maintained in order to have a high level of quality in the finished product. Three different types of folded back springs are made on the machines shown; the principles of inspection and quality control are similar for each.

(To be continued)

★ ★ ★

Navy Takes Work to Tools to Help Break Bottlenecks

A number of firms with difficult defense production problems are finding a solution to their problems in a recent "bring the work to the tools" offer made by the Navy.

This new program is designed to assist defense production by relieving bottlenecks. It is a temporary measure for firms requiring heavy machine tool operations to complete defense contracts on schedule when such tools are not available to private industry.

Currently several defense contractors are having machine work done at the New York Naval Shipyard to break bottlenecks in their production schedules.

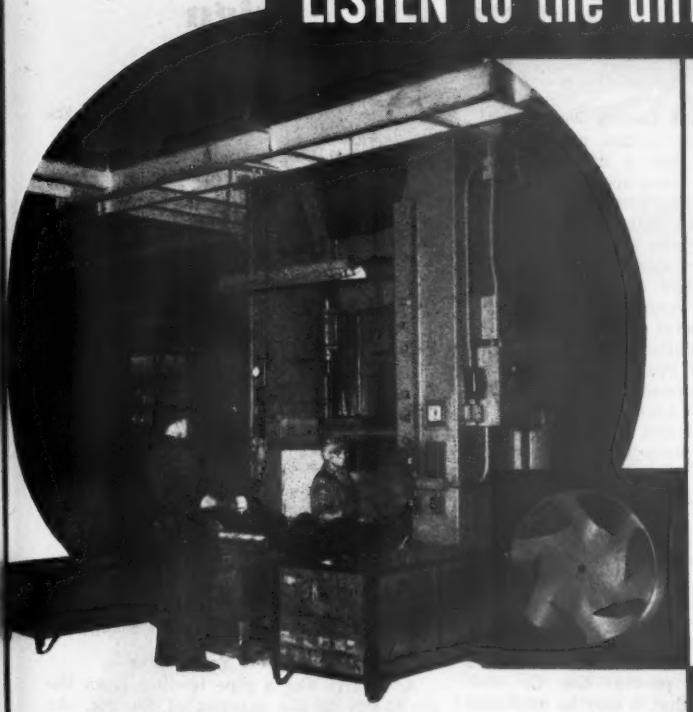
Officials of Republic Avaiation Corp. visited that yard recently to see if it could assist in machining approximately 75 forgings. The work was being done by a private contractor who did not have enough machines to complete the job on time. Yard officials said they could and would do the work.

The next day eight forgings arrived at the shipyard and a certified check to cover the cost of the work was delivered to the shipyard office. Work was started immediately.

Within two weeks the job was on its way to completion and the bottleneck was broken.

The shipyard also is undertaking machine work on 16 T-43 tank hulls for the Chrysler Corporation's Newark, Delaware, plant.

LISTEN to the difference



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Die Casting Die Design

Part VI.

by H. K. Barton
and
James L. Erickson

Venting Die Casting Dies

As the incoming molten metal surges through the gate into a die casting die cavity, it exerts a force upon the air within the die cavity. This force is of considerable magnitude and tends to (1) compress the air, (2) force the air out of the die cavity through any openings large enough to permit its passage, (3) combine the air and molten metal chemically, (4) mix the air and molten metal physically, and (5) possibly dissolve portions of the air.

If there are no avenues of escape for the air, it will become compressed to a degree dependent upon the compressive force exerted on it, and it will prevent the uniform and complete filling of the die cavity by molten alloy. The presence of the air will cause the subsequent casting made in the die cavity to be host to porosity of one sort or another. Therefore it is desirable to provide the air with escape avenues so that it may be displaced completely from the die cavity by the incoming molten alloy.

It is the purpose of this discussion to describe the type of avenues of escape which may be employed by the die designer in his design of a die casting die, and to further point out the advantages and limitations of each of these types of escape avenues, or vents.

The Nature of a Vent

A vent is any passageway leading from the die cavity to the exterior of the die proper which permits the free passage of air out of the die when the molten alloy is forced into the die cavity and which does not permit the passage of molten metal.

Vents may be unintentioned (but none the less useful) or they may be the result of deliberate planning on the part of the die designer.

An example of an unintentioned vent is a vent created by the loose fitting of movable cores, ejector pins, and a lack of a perfect seal between the two die face halves that form the shut-off face of the dies.

While unintentional vents are frequently advantageous in their effect, they cannot be counted on to be present in each die, nor if they are, to be of sufficient magnitude or location; consequently, it is essential to employ vents especially designed and positioned to accomplish the displacement of the air in the short time interval of die filling.

A vent, therefore, is a passageway that will permit the free passage of air but not that of molten alloys from the die cavity to the die exterior.

The Function of a Vent

The function of a vent is to provide the air* with an avenue of escape without permitting the molten alloy to escape.

The Way the Vent Works

A vent is like a pipe leading from the die cavity to the exterior of the die. As the pressure builds up on the air within the die as the incoming molten alloy surges into the die, the air flows through the vent to the space of lower pressure at the die's exterior. The rate of flow of the air through the vent is dependent upon several factors such as (1) the pressure differential between the air in the die cavity and atmospheric pressure, (2) the temperature of the die, (3) the dimensions of the vents, viz. its cross-sectional area and length, (4) the temperature of the incoming molten alloy, (5) smoothness of the vent surface (6) the pattern of the vent passageway, (7) the density of the air, (8) rate of increase of pressure within the die cavity (determined for the most part by the rate at which the molten alloy fills the die cavity), and in some instances by (9) the magnitude of the final pressure applied to the molten alloy just before the alloy solidifies.

*The gaseous atmosphere within the die cavity.

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Fortunately the designer does not have to design his vents so that they will just get air out in time by using the minimum amount of venting, for were he forced to do this he would be confronted with an insolvable problem in physical chemistry. The designer need only "over design" his vents as it were. Excessive vents seldom do any harm.

On the other hand, many designers are not aware of the fact that it does take considerable venting to effect the total escape of air from the die, and consequently they fail to employ enough vents of the proper design and to strategically locate these.

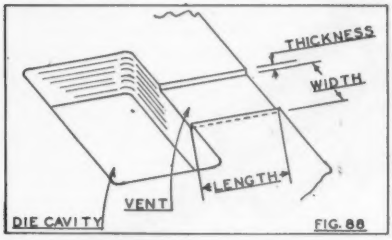


Fig. 88. For clarity of reference to vent dimensions, *length* is the distance the air must flow from the point of entrance to the point it leaves the vent. *Width* is the largest cross-sectional dimension and *thickness* is the smallest cross-sectional dimension.

Vent Dimensions

For the sake of clarity, we shall consider the length of a vent to be the distance the air must flow from the point where it enters the vent to the point where it leaves the vent, Figure 88. The width of a vent shall be its largest cross-sectional dimension, while its thickness shall be its smallest cross-sectional dimension.

Basic Vent Design

A vent by definition must permit air to pass through it, but not molten alloy (even under high pressures).

Experience has shown the die designer that if he designs the cross-sections of his vent passages, in certain ways, molten metal will not flow through them. By trial and error he has arrived at certain vent thickness which if exceeded permit the flow of molten alloy, so he designs according. A table of widths for various die casting alloys follows:

Alloys	Maximum Vent Thickness in Inches
Lead	.0035
Tin	.0035
Zinc	.0050
Magnesium	.0080
Aluminum	.0080
Copper	.0070

As molten metal flow is limited by the smallest cross-sectional dimension, namely thickness, it is necessary only to control this dimension in order to prevent molten metal flow, and this is precisely what the designer does.

Basically, the vent thickness is limited to a maximum value, while the width is varied to alter the cross-sectional area of the vent and hence the volume of air that may flow through it per unit of time.

In designing a vent, the designer always begins right off with the maximum thickness and then never varies it, but he may increase the vent width, or add additional vents, to facilitate a greater rate of flow of the air from the die cavity.

Major Types of Vents

There are two major types of vents: accessible and inaccessible.

An accessible vent is one that is accessible to the die casting machine operator

(Continued on page 86)

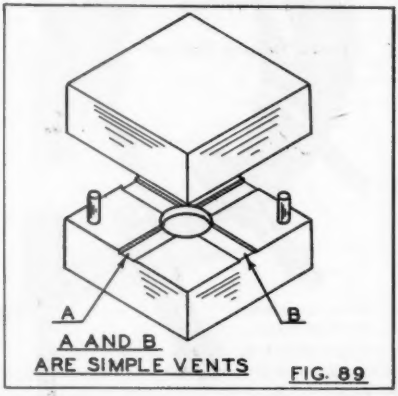
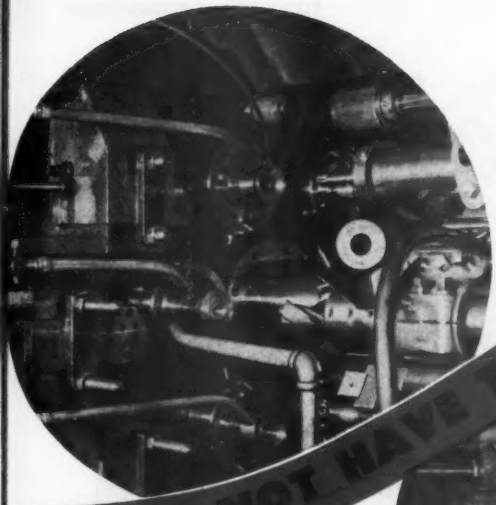
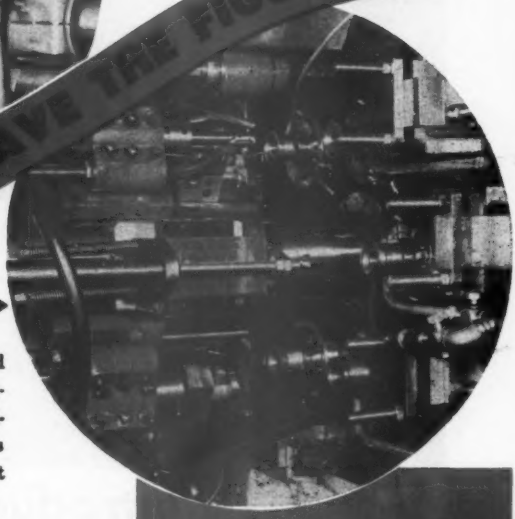


Fig. 89. Typical accessible vents, A and B, most frequently used are cut into the face of the die and lead from the die cavity to the edge of the die.



WHY NOT HAVE THE FIGURES?

Front Side of Tooling Area
Rear Side of Tooling Area



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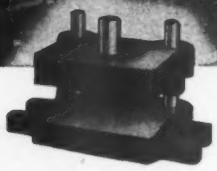

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. . . Die Casting, from page 82

during his operation of the die so that he can keep the vent free from obstructions and prevent it from being blocked or clogged.

An inaccessible vent is one that cannot be "serviced" as it were by the die caster because it is situated in such a manner or location that it cannot be readily looked after, cleaned, etc. To properly function, vents must be kept clean and open to permit it to pass air. If a vent becomes blocked or clogged it is no longer of functional value.

Accessible Vents

The most frequently employed type of accessible vents is that which is cut into the face of the die and which leads from the die cavity to the edge of the die, as illustrated in Figure 89. Vents of this type lend themselves to easy cleaning by the die caster during the actual operation of the die.

Another type of accessible vent is that which is cut onto the side of a movable core which is exposed to the die caster each time the die halves part, as shown in Figure 90.

Still another type of accessible vent is the type which is cut onto the side of a stationary core which becomes exposed each time the die opens during its operation, Figure 91.

In each of the foregoing three types of accessible vents, the vent area itself is exposed to the die caster who can wipe it clean with his glove as frequently as may be required to keep it functioning properly.

Another type of accessible vent is the one cut onto the side face of an ejecter pin, shown in Figures 92, 93, and 94. Vents of this kind become exposed and cleanable when the ejector pins project through the die block during the ejection of the die casting. Vents cut on the side of ejector pins offer a possible escape for the air from the die cavity for a short distance through the die block to a cut out area, seen in Figures 93 and 94.

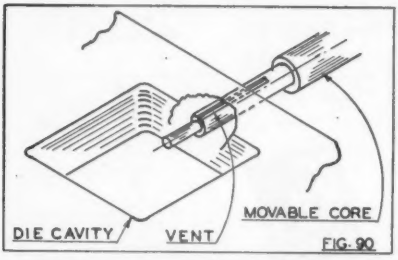

Fig. 90. A vent cut onto the side of the movable core, which is exposed to the operator when the die halves part, is one type of accessible vent.

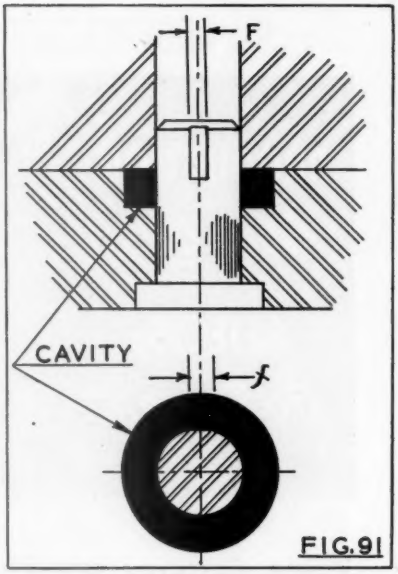

Fig. 91. A vent cut onto the side of a stationery core which becomes exposed when the die opens, is another type of accessible vent. "F" indicates the vent on the surface of the core while "f" shows it as a flat surface in the cross-section view.

Inaccessible Vents

Typical inaccessible vents are those that are cut onto the sides of stationary or movable cores, but which never become fully exposed during the operation of the die, as shown in Figure 95.

Relative Merits

The writers believe that vents of the inaccessible variety are not worth the cost of creating them during the construction of the die and that it is best to employ only accessible vents. Nontheless, numer-

(Continued on page 90)

BARNES

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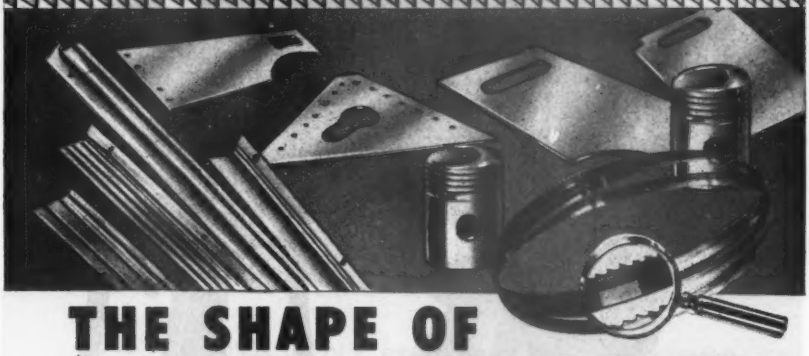

THE SHAPE OF THINGS TO CUT

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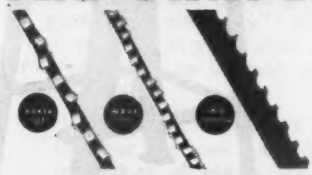

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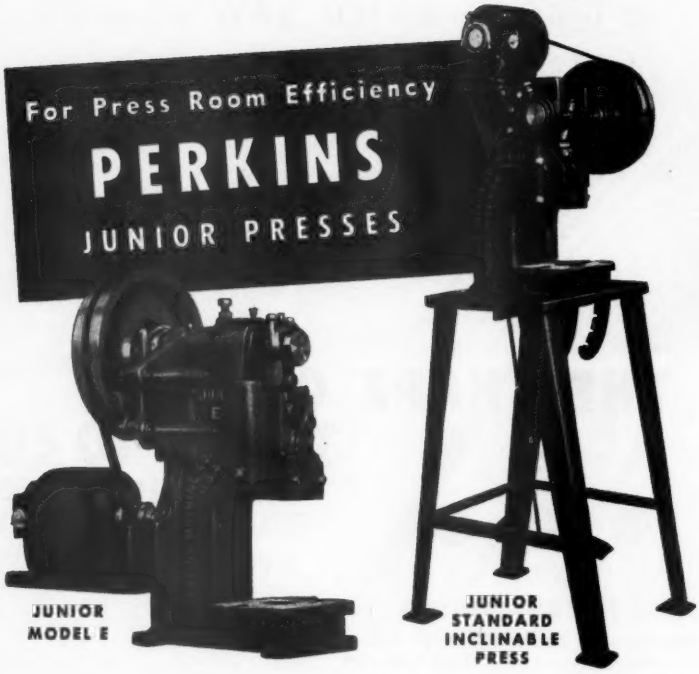

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. . . Die Casting, from page 86

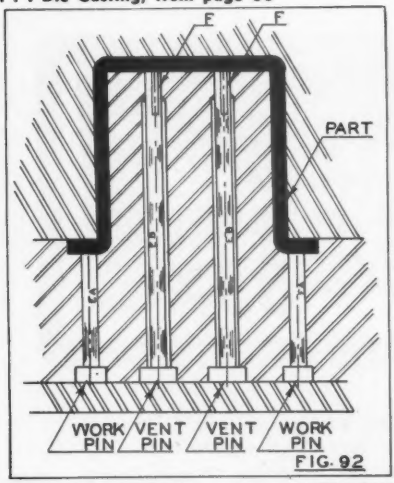

FIG. 92

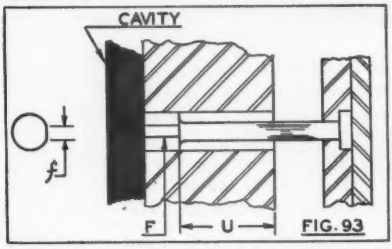

FIG. 93

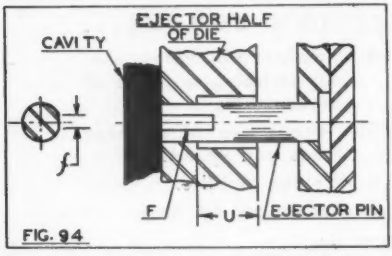

FIG. 94

Figs. 92, 93, 94. A vent cut on the side face of ejector pins is still another type of accessible vent. Fig. 92 shows four pins, two of which have vents cut on them at F-F. These vents become exposed and cleanable when the pins project through the die block. Fig. 93 shows at U a reduced diameter of the ejector pin which leaves an air passage in the die from the cavity through the vent F and out of the die. In Fig. 94 the diameter of the ejector pin is contant, but the air passage U is cut out of the die, allowing the air to flow from the cavity through F and then escape.

ous experienced die casting designers persist in their use of inaccessible vents forgetting that vents may become clogged by other material than frozen metal and that although molten metal cannot get inside of the vent to clog it, other materials such as die lubricant can find their way into the vent and block it.

Blocking of Vents

If a vent is blocked in anyway, its function is impaired and its usefulness lost. This is a vital fact the designer must bear in mind when he designs and locates vents.

Vents may become blocked in one or more of several ways. The most obvious of these are (1) with flash, (2) with oxide build-up, (3) with die lubricating oil and carbonaceous deposit, (4) with peening

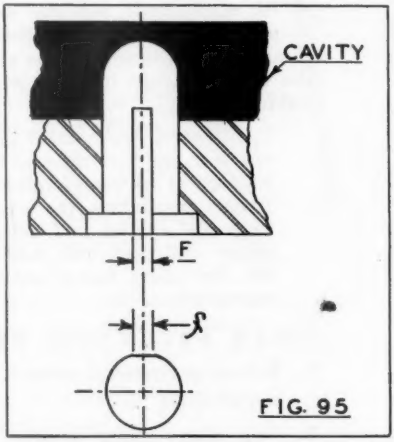

FIG. 95

Fig. 95 shows a vent F cut on the side of a core, but is located so that it never becomes fully exposed in the operation of the die. It is therefore not possible to clean a vent so located and thus it falls under the type of inaccessible vent, whether used on either stationary or movable cores.

over and sealing off of the mouth of the vent, and (5) solidifying metal at the mouth of the vent before the vent has had time to function as an escape passage.

The occurrence of any one of the foregoing conditions is in part dependent on the design of the vent and its location in relation to the die cavity.

(Continued on page 98)

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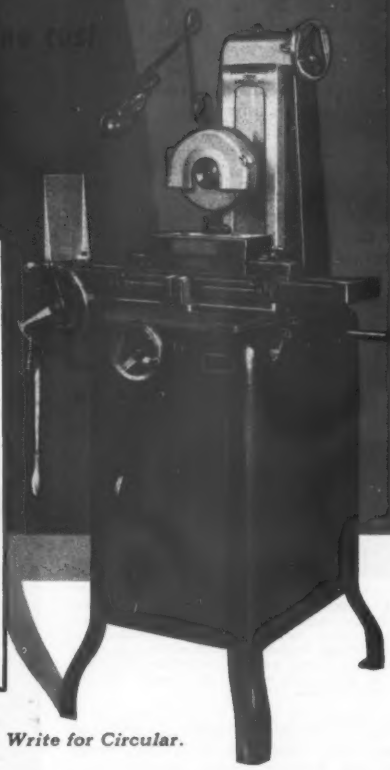

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SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

Hydraulic Powered Piercing of Jet Engine Parts

A significant disclosure was made on December 17th of a new machine and tooling designed for piercing slots in jet engine shroud rings.

The shroud rings range in diameter from just under 20" to nearly 30". The slots or openings pierced in the rings are equivalent in shape to the cross-sectional area of a jet blade. A hole of such a shape is both difficult and costly to machine by virtue of shape alone.

When additionally, a material such as stainless steel alloy of approximately ¼" thickness is involved, the machining difficulties and costs are multiplied.

Consequently, there was no lack of incentive for devising a method whereby the slots could be produced by the fast and relatively simple punching technique. This has been done and with full recognition of the difficult shape, material and tolerances specified.

Fig. 1. This front view shows the compactness of the hydraulic piercing machine. The operator's station is located conveniently with respect to the work. During actual production the operator places the workpiece on the locating ring and locks it in place, as shown by means of the clamping mechanism.

The same setup with simple changes in punch and die members may also be utilized for piercing peripheral holes in such components as automobile wheel rims or other circular parts.

These new machines are being built by Danly Machine Specialties, Inc., Cicero, Illinois, and are based upon original developments by the Mueller Engineering Company of Dearborn, Michigan.

The piercing unit is of a patented floating type actuated by a hydraulic cylinder. The hydraulic power cylinder acts as the cross head slide. All wear surfaces are

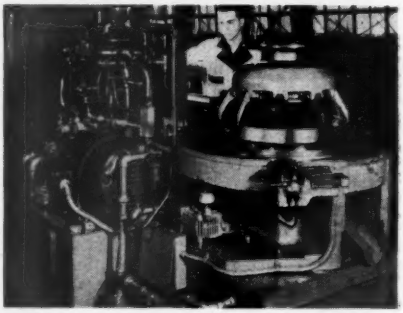

Fig. 2. From the rear can be seen the work table (right) including indexing ring, clamping fixture securing the jet engine shroud ring. Shown left, are the motor and hydraulic power unit. Every item is arranged for simplicity of adjustment and maintenance.

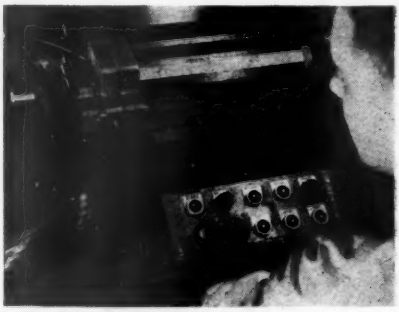

Fig. 3. The machine may be operated automatically or manually by means of a selector switch. Manual operation of the machine is obtained by pushing the various buttons on the control panel corresponding to the cycle desired as marked on the buttons. The operator is shown starting the automatic piercing cycle by pushing the momentary contact switch. The cycle starts as the C-frame moves toward the piercing position and continues until the die makes contact with the surface of the part.

hardened and ground and its long guides provide maximum rigidity and, therefore, perfect alignment between punch and die. The cylinder is also equipped with a hydraulic stripping mechanism; consequently, no springs are required and changing of tools is much simplified.

The hydraulically operated C-frame slide eliminates distortion of the part while piercing and also the part is clear of the die block during the index cycle, eliminating danger of marking the part and wear on the die block.

Actual force to perform piercing operation is equalized; the part is rigidly pinched between punch and die with the same force on both sides, thus preventing distortion.

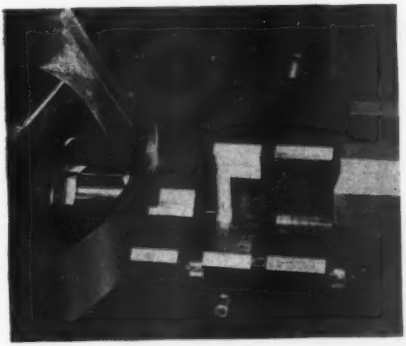

Fig. 4. This closeup of the piercing operation shows the stripper, die and workpiece located as the piercing operation is performed. The power cylinder is shown in place. Its approach has been rapid under a primary fluid pressure until the stripper plate contacts the part, at which time pressure rise in the primary system causes the spool of the selector valve to shift: instantaneously a 5 to 1 ratio continuous booster actuates to supply high pressure fluid for the actual piercing operation.

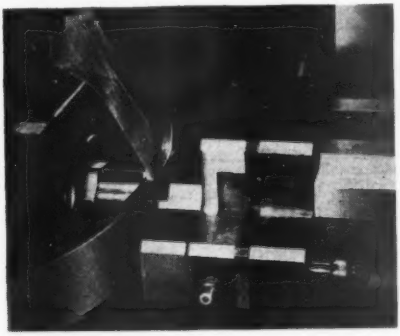

Fig. 5. The stripper is shown still clamping the work ring but punch has just been withdrawn. Note the clearance between the stripper plate and the punch mounting plate as compared with that shown in Figure 4. A time control relay causes the flow of the hydraulic fluid to be reversed, thereby withdrawing the punch and returning the power cylinder to the open position. Simultaneously the C-frame slide returns also to the open position. As soon as the power cylinder has returned, a limit switch is actuated, directing fluid to the locking latch cylinder of the index mechanism.

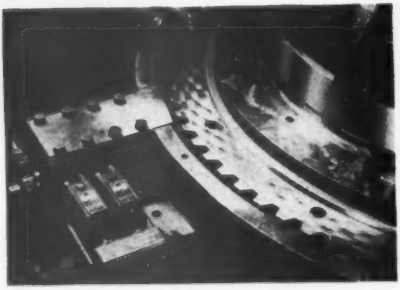

Fig. 6. This view of the hydraulic piercing machine shows the indexing ring and the lock pin. A safety switch insures that the punch cannot move until the locking pin is firmly seated and, conversely, the pin cannot be withdrawn until the punch and die are clear of the workpiece. The index table starts rotating as soon as released; the instant the locking latch reaches its open position, pressure in the actuating cylinder of the locking latch is reversed, causing the index latch to engage the ring in the next index notch. As soon as index latch is in position, a limit switch again will start the piercing cycle. This sequence of piercing operations continues until the index table has rotated 360° at which time the machine will come to a complete stop. The operator may then unload the completed part and the machine is ready for reloading.

A unique indexing mechanism assures accurate spacing and will reproduce uniform parts consistently. The master index ring is quickly interchangeable and location of holes will be pierced according to the location of the slots in the master ring. An index mechanism of this type makes it possible to vary the spacing between holes or groups of holes as the case may be.

A constant torque is applied to the index table and is actuated by means of a

(Continued on page 168)

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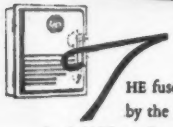
makes this intricate job possible



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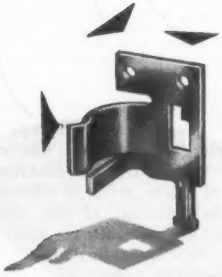

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2.	3/4"	x	1/2"	8.	A-61	3/4"	x	1"
3.	3/4"	x	1/2"	9.	A-90	1/2"	x	1/2"
4.	5/8"	x	3/4"	10.	A-41	5/8"	x	5/8"
5.	3/4"	x	3/4"	11.	A-111	1"	x	1"
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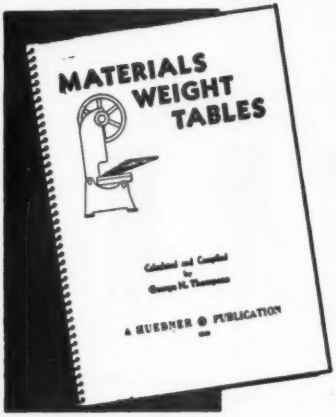

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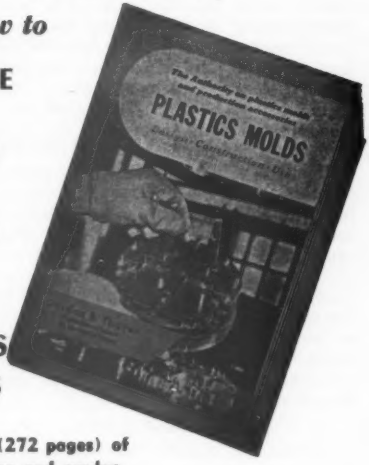

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. . . Die Casting, from page 90

Flash Blocking

If a vent is too thick, molten metal will flow into the vent for some distance before it is sufficiently chilled to cause it to solidify. When this happens, the solidified metal that lies within the vents may adhere to one of the faces of the vent and remain after the die casting is ejected. Subsequently, if this metal flake, or flash, is not removed before the following casting cycle, the vent will remain blocked and quite useless. For this reason, it is best to make certain that vent faces are polished to the same degree as die cavities in order to minimize adhesion of flash, as well as to also avoid the employment of too thick vents. The latter is particularly important in connection with vents that are located in positions where the die casting machine operator cannot readily clean out flash that might form in the vent, i.e., in the inaccessible vents. Vents cut into the parting face of the die halves, as shown in Figure 89, are, of course, accessible to the die casting machine operator and lend themselves to routine cleaning.

Carbonaceous Build-up

Certain die casting die lubricants tend to become reduced under heat and pressure to hard compounds that build up on the surfaces of die members to which they are applied. When these compounds are allowed to build up in vents, the vents become blocked. For this reason, vents which are not readily cleaned by the die casting machine operator are more likely to become clogged by carbon deposits, thereby actually preventing the escape of air, than are vents which may be easily cleaned. For this reason, it is not good die design practice to locate inaccessible vents where they are likely to become clogged with die lubricant as in the case of vents along cores that of necessity will require frequent lubricating in production, such as in the case of cores employed in aluminum die casting that are long and possess minimum draft.

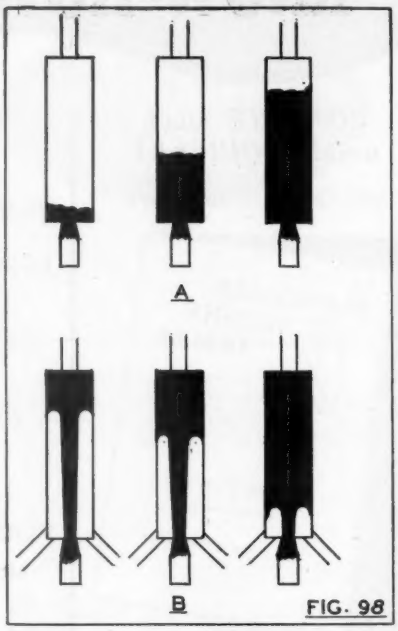
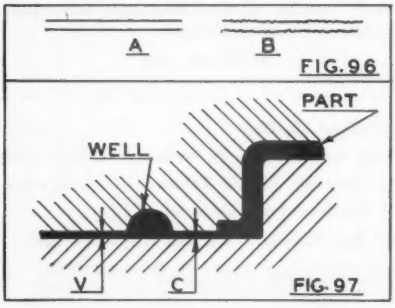


Fig. 98A and B illustrate the ideal placement of vents in relation to the die cavity that is filling with molten metal. In both cases the vents are located so that the air is forced into the vents ahead of the incoming metal.

Fig. 96-A represent the polished smoothness required in a trouble free vent as compared to B representing a vent lift with tool marks and other roughness. Fig. 97 shows a vent V, having its origin in an overflow well, the overflow being connected to the cavity by channel C.



Oxide Build-up

Certain die casting alloys tend to form oxide deposits on the die faces against which they solidify. Typical metals are certain copper-zinc base alloys and the

(Continued on page 102)

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ORIGINATED **BY** UNBRAKO

. . . the screws that won't work loose

Unique counterclockwise knurls make these UNBRAKO Set Screws self lockers, prevent creep and subsequent loosening. Because UNBRAKO Self-Locking Set Screws stay tight, even in poorly tapped holes, they reduce maintenance costs and production losses. Write for descriptive literature. STANDARD PRESSED STEEL CO., Jenkintown 36, Pennsylvania.

SPS recommends STANDARDS—#4 to 1" available from UNBRAKO distributors' stocks.

Ask your UNBRAKO distributor about deliveries. You'll be pleasantly surprised.

UNBRAKO SOCKET SCREW DIVISION

SPS

JENKINTOWN 36, PENNSYLVANIA

SEE ADVERTISERS INDEX. PAGE 137. FOR KEY NUMBERS

. . . Die Casting, from page 98

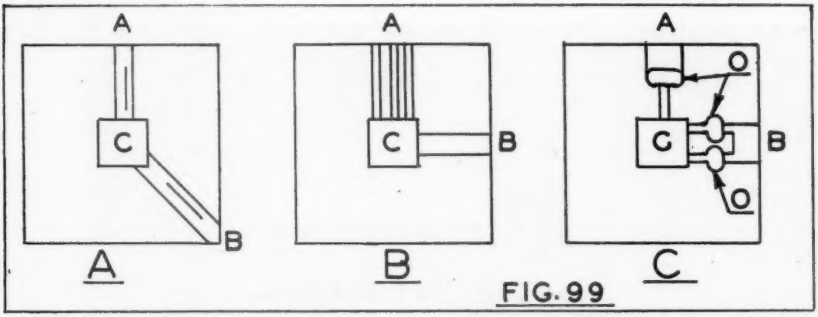

Fig. 99A. The length of a vent should be as short as possible; therefore, A is preferable to B because it is shorter. Fig. 99-B. Sometimes two or more vents of small width, as shown at A, are preferable to one of greater width, as at B. Fig. 99-C shows how vents A and B can be led off of overflows O.

majority of magnesium base alloys. When these oxides build up in the vicinity of the vent's mouth, they tend to reduce the effective area of the vent and may, if sufficiently great, block the vent entirely. And, unless this oxide build-up can continually be removed by the die casting machine operator by one means or another, it will render a vent useless in a relatively short time. Consequently, when designing die casting dies to be employed in making magnesium and brass die castings, it is best to rely only on accessible vents to evacuate the entrapped air rather than on inaccessible vents.

Surface of Vents

The surfaces of vents must always be polished smooth as represented at A, Figure 96, and free of tool marks and other roughness as indicated at B. When vents are rough they become difficult to keep clean and also they tend to retard the flow of gas through them.

Vents and Overflows

Many times accessible vents will have their origin not in the die cavity proper, but in an overflow, as illustrated in Figure 97.

Location of Accessible Vents

There are unfortunately no hard and fast rules to assist the die designer in the placement of vents. Naturally it is desirable to locate vents so that they will not be sealed off the moment the incoming molten metal enters the die cavity and before the air within the die cavity has had the opportunity to escape through the vents.

The foregoing is obvious, but what is not obvious is just where this location is, for it is merely next to impossible to predict accurately just how the molten metal will behave when it enters the die cavity.

Figures 98A and 98B illustrate the ideal placement of vents in relation to a die cavity that is filling with molten metal. In both cases, the vents are located in such a way that the air is forced ahead of the incoming molten metal into the vents.

There are two schools of thought in regard to the placement of vents: one school puts vents into the die during its construction so that the vents are present when the die is first tried out. Enough vents are put in to take care of any contingency, that is, vents are plentiful and if one is not located properly the chances are another will be.

The second school refrains from the use of vents until after a trial run of the die has been made; then, vents are put in where it is felt they will do the most good.

Design of Accessible Vents

It is best to keep the length of the vent as short as possible. In Figure 99A, vent "A" is therefore preferable to vent "B" for it is the shorter path from the die cavity "C" to the edge of the die.

The designer may find it preferable to

(Continued on page 119)

Atlas CLAUSING

12" LATHE

6300 SERIES
1" Collet Capacity, 1⅜" Bore
A.S.A. L-00 Tapered Key Drive Spindle

HEAVY DUTY PRECISION V-BED

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No. 7515 Taper Attachment

EVERY feature that makes a precision lathe is incorporated in the Clausing 6300 series. Steel spindle is forged, precision-ground-nose is hardened, ground — turns on selected Timken tapered roller bearings. Headstock gears are steel, run in oil. Dual V-belt drive. Heavy bed combines 2 precision-ground Vee-ways and 2 precision-ground flat ways. Apron is *heavy, double-walled, automatic* — with splash lubrication, positive clutch, steel and cast-iron gears. 8 speeds — 50 to 1300 RPM. Variable drive (optional) provides infinite range of speeds between 30 and 1400 RPM. Quick change ½" steel gears run in oil — instant selection of 48 threads or feeds, from 4 to 224. ⅞" Acme thread lead screw — supported in gear box by two Timken tapered roller bearings. 12¾" swing over bed. 7½" over saddle. 24"–36"–48" between centers.

An outstanding lathe, an outstanding value. Catalog sent on request.

Atlas CLAUSING PRECISION MACHINE TOOLS DIVISION ATLAS PRESS COMPANY KALAMAZOO, MICHIGAN

ATLAS PRESS COMPANY
184 No. Pitcher Street
Kalamazoo, Michigan

SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

. . . Work Handling, from page 66

can be employed for blowing dirt or chips from the die as need may arise.

Use of vacuum cup lifters and feeders around presses is naturally limited to handling flat stock. However, the safety tongs formerly mentioned are not the only means available for safe manual handling of formed pieces. There are also mechanical pickers, which are operated from an air line, and provided with a grip and a thumb button. Such pickers are fitted with jaws made of aluminum. Thus, work is not marred in handling, and dies are not damaged if by chance the picker is caught between punch and die.

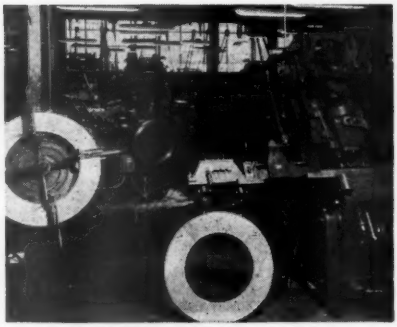
Different Styles of Jaws Used

Such pickers may be fitted with various types of jaws to suit almost any handling requirement. Some have a design of jaws suitable for feeding flanged shells; others for feeding cups with their edges upward. It may readily be seen that regardless of the type of work which must be manually fed to a press, it is possible to provide facilities allowing an operator to keep his hands completely out of the danger zone.

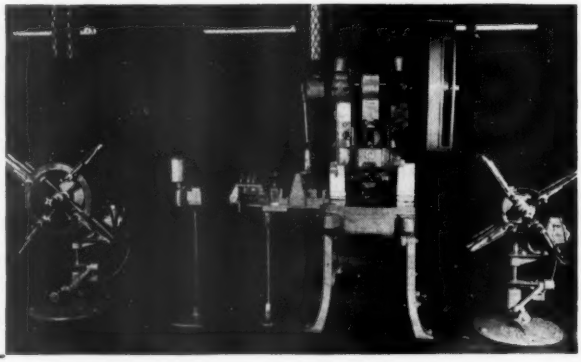
It is often found advisable to make use of a stock table in front of a press, for feeding flat stock or strip into the dies. One interesting aspect of use of such tables for supporting and handling stock is the fact that some of them can be equipped with oilers, which oil the stock being processed on both sides. This automatically oils the die, as well as the punch.

Stock being fed passes between oiling rolls. The oiling rolls are spring loaded. Thus, they spring apart just as far as necessary, and will oil stock of various thicknesses passing between them, without any necessity for making a roll adjustment. A high grade of felt is used on such rolls, to insure that oil will be uniformly applied to the surfaces. Some of these stock tables are supported on a pair of standards rising from heavy disc-type bases. The standards are adjustable, up and down, and the top of the table can be tilted to any desired angle. In addition to being highly convenient for use with punch presses, tables of this type are also used for handling material at other machines.

(Continued on page 108)



This shows a Minister press arranged with a U. S. Tool slide feed, U. S. Tool plain straightener, and also a U. S. Tool plain stock reel of the centralizing type. This kind of steup converts the press to an automatic machine.



This V & O press installation is similar to that shown above. In addition to an automatic slide feed and stock straightener, two automatic stock reels are in use on this operation. The one at the left unwinds the strip stock, and the one at the right reels up the scrap.

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LAYOUT, DRILLING
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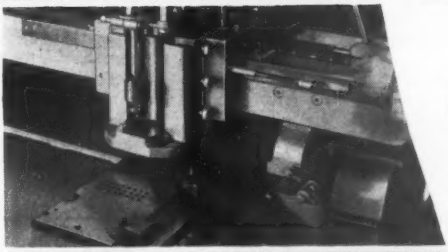
"Necessity is the mother of invention" ... that is why the Wales Drilling Machine became a reality... there is no other drilling machine or jig borer like it... it meets the definite need of precision locating, drilling and reaming holes in material of practically any length and up to 36" wide.

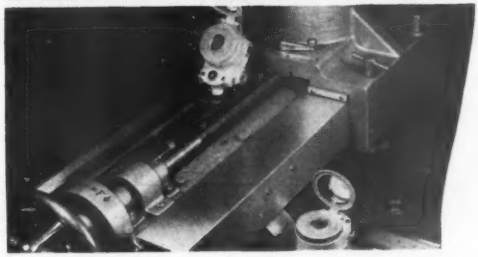
Accuracy is the primary consideration in the manufacture of this *exclusive* Wales Drilling Machine which combines simplicity of operation... easier locating... faster drilling and reaming... and very close tolerance production.

Have the facts about Wales Drilling Machines at your finger tips by writing TODAY for the fully-illustrated, functionally-colored Catalog D.M.



g the Wales Drill-chine in operation. the large size tem-with holes being on large unob-table.

ning holes being ely reamed in a ork piece.



g a Wales Exten-ller Table at each the Wales Drilling e. Note the long ece that extends both extension from the machine

g "zeroing in" for is accuracy by precision optical

WALES-STRIPPIT CORPORATION

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(Between Buffalo and Niagara Falls)

Wales-Strippit of Canada Ltd., Hamilton, Ontario

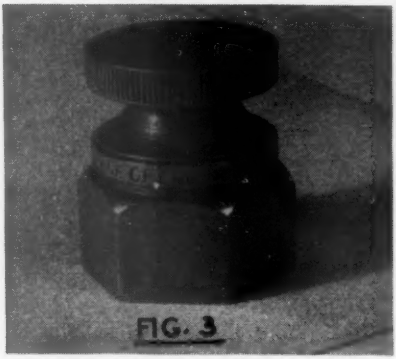
Specialists in Punching and Notching Equipment

Stenciling Piece Parts in Screw Machines

A very interesting technique has been developed for identifying and marking various piece parts by stenciling through screw machine operations.

Paper weights, as shown by Figure 1 and Figure 3, were made from 1" hexagon 1020 bar stock, and the piece part was stenciled with the words "University of Minnesota, College of Engineering" by the stenciling tool "B". The straight knurled section of the paper weight "E"

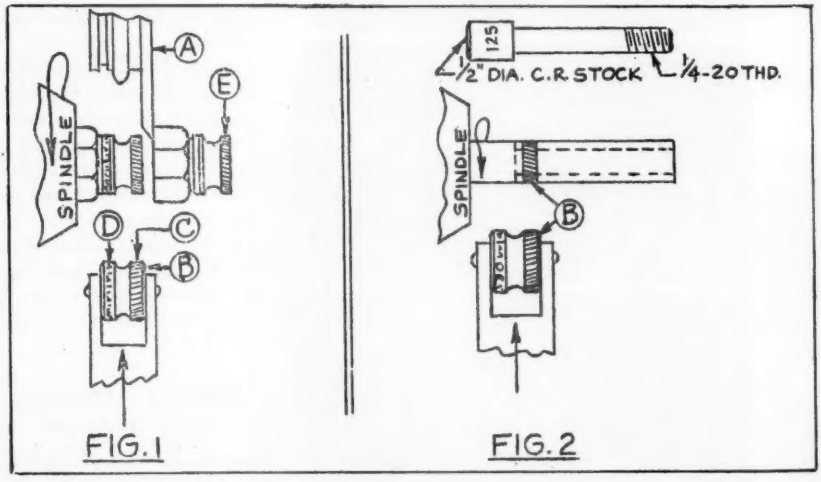
by **Dayton Rogers**
President
Dayton Rogers Manufacturing Co.
Minneapolis, Minn.



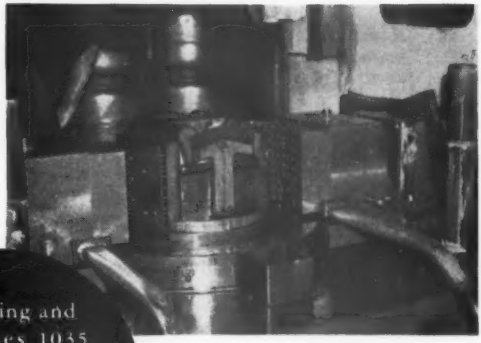
served as a driving means for driving the entire combination knurling and stenciling tool, thus compensating for the spacing of the wording. The diameters of the knurling tools at "D" and "C" coincide with the same diameter of the straight knurl "E" on the finished part.

The combination forming and cutoff tool "A" was carried in the rear tool post of a Cleveland screw machine. Knurling and stenciling was done by the roller tool "B" after the cutoff and forming operation.

Figure 2 briefly shows how a stock number or other identifying means can be stenciled on a given bolt, stud or other screw machine product in either automatic or hand screw machine operation. While the straight knurl "B", Figure 2, has no value on the finished stud or bolt, it is merely a means for driving the stenciling or marking section of the combination stenciling and knurling tool "B". This straight knurl is removed when machining the shank to its size for threading.



In tooling too...
Verson Engineering Pays Big Dividends



Close-up of the indexing and piercing die before inserting the tub.

THIS Verson indexing and piercing die punches 1035 holes from the inside out in Maytag washer tubs . . . in 6 consecutive automatic press strokes it performs operations that formerly required 4 horning presses.

The tub at completion of the six stroke cycle that punches the 1035 holes.

Originators and Pioneers of Allsteel Stamping Press Construction

VERSON ALLSTEEL PRESS COMPANY

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MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING
DIE CUSHIONS • COMPRESSION AND TRANSFER MOLDING PRESSES

SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

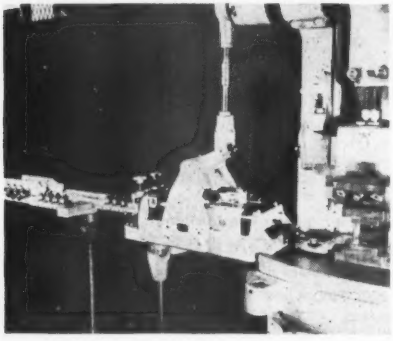
. . . Work Handling, from page 104

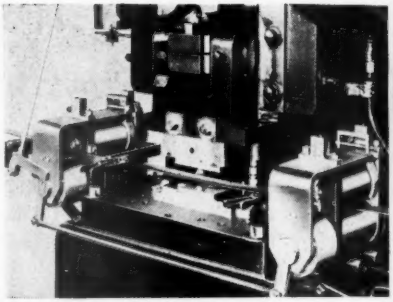
Elevating Table and Feed Rack Combination

There are certain types of elevating tables considerably used for transferring heavy work from machine to machine, for removing dies from storage shelves and placing them in presses, or vice versa. Some of these can be provided with a special rack, so they will serve as a stock table for feeding material onto the bed of a punch press. These racks have eight adjustments up to a 45 degree pitch, and will remain set in any of the eight positions in which they are placed. The rack mentioned is readily removable from the elevating table proper. Thus the device may be made to serve in either of the two capacities mentioned. When equipped with a rack, such a table eliminates manual lifting of material to the pitch of the punch press bed.

In occasional cases, given presses are used almost exclusively for working sheet stock of large area. It may then be found wise to install an elevator or lift on one or both sides of the press, as expediency may dictate. Using a lift of suitable type, having a proper control, a press operator can gradually and progressively lift a stack of sheets being fed, enough to compensate for loss in height. In other words, the stack can be gradually lifted, as sheets are fed from the top of it, so the top of the stack will always be at press-bed level. If sheets are being received from the press onto a lift, that lift will be gradually lowered as the stack increases in height, providing maximum handling convenience continually.

Details of a U.S. Tool slide feed applied to a V & O Press. In this setup the slide feed is arranged with two 2-way wire straighteners, and two wires are being fed to the press simultaneously.





This close-up shows the details of a roll feed made by Felt and Tarrant, which incorporates two indexing clutches in the manner described in the text, the clutches being made by Morse Chain Company.

Dial Feed Applications

There are many cases (where small pieces are to be handled in presses) where the best solution to the feeding problem, production-wise, has to do with use of a dial feed. Dial feeds obtained from some sources are rapid, safe, and highly efficient, producing from 15,000 to 20,000 pieces a day. They are well adapted for performing some types of high-speed assembly work, and are also considerably used for certain kinds of second operations, such as shell perforating. If desired, operation of dial-feed units may be made completely automatic, because magazine feeds can be supplied to work in conjunction with them. Dial feeds can be and are applied to ordinary punch presses, as well as to large straight-sided presses.

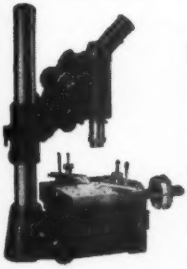
Both blanking and drawing presses can be and are served by dial feeds. There are some cases, in high-speed assembly and second operation work, where a special motorized dial-press type of machine is better adapted to production than application of separate dial feed to a press already on the floor. One motorized dial-press machine observed, much used for this type of work, has a table large enough for several operators to sit around it and load pieces into assembly dies. It is possible to run the dial feed at selected speed, in keeping with any particular type of

(Continued on page 112)

FOUR OPTICAL AIDS to help you SAVE MATERIAL and MAN-HOURS!

1 CONTOUR MEASURING PROJECTOR

Save time and money—*more accurate measurements than with any other projector!* Angular measurements to ±1 minute of arc, with protractor screen. Direct linear measurements to ±.0001" over 4" x 6" range, with cross slide stage. Spot inaccuracies quickly and simply. Compare production-run parts directly with a *traced outline* of the projected image of the master part, or with a large scale drawing superimposed on the screen. *Catalog* D-27.



2 TOOLMAKERS' MICROSCOPE

Linear measurements to ±.0001"; angular measurements to ±1 minute of arc, with protractor eyepiece. Simple, quick measurement of opaque and transparent objects of any contour. *Catalog* D-22.

3 STEREOSCOPIC WIDE FIELD MICROSCOPES

Sharp, three-dimensional, unreversed images. Speed and accuracy in small parts assembly operations, inspection of tools and finished parts, and precision machining of small parts. 15 models, widely used in industry. *Catalog* D-15.

4 *New* PARA-PLANE GAGES

Now you can have "laboratory" accuracy of 0.000001" in the determination of flatness and parallelism of reflecting surfaces... with production-line *simplicity* and *speed.* So simple that an unskilled operator can take measurements after a few minutes of instruction. Two sizes available. *Bulletin* D-224.

WRITE for full information on these four important optical aids, to help you save time and money. You may be paying many times over their cost in lost time and rejects. Bausch & Lomb Optical Co., 798-13 St. Paul Street, Rochester 2, N. Y.

B&L Bausch & Lomb *Quality Control* Instruments

SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

Transfer Facsimile Method Gives Quick, Clean and Dry Photo Copies

This new machine makes it possible, for the first time, to produce dry photocopies of anything almost instantly, and without the slow, messy developing, fixing, washing and drying ordinarily required by photocopy methods. The Auto-Stat is based on an entirely new principle of instant and automatic developing and fixing. It enables anyone, without training or special skill, to produce clear, black and white photo-exact copies of any original in any office.

This new method is fast because it involves only two simple steps and there is no time-consuming print drying. A finished copy can be made in less than 30 seconds.

The process is clean since it does away completely with chemical trays, running water and wet hands.

There are no limitations as to type of papers, documents or originals that can be copied, regardless of whether the original is printed on one or both sides or on opaque or translucent paper. The Auto-Stat eliminates the necessity of making intermediate copies of opaque originals.

The Auto-Stat operates on a transfer facsimile principle that employs two different types of paper—a No. 1 sheet sensitive to light and a No. 2 sheet not sensitive to light. Both papers are coated with special emulsion developed and patented by the makers of the Auto-Stat.

In the simple two-step process of making an Auto-Stat copy, the original to be copied is placed face to face with the No. 1 sensitized sheet and then inserted in the contact printer. After a 10 second exposure to light, the original and No. 1 sheet are removed from the contact printer. The original is set aside, unharmed in any way. Next, the exposed No. 1 sheet is placed in face to face contact with the No. 2 sheet and both sheets are inserted in the slots at the front of the Auto-Stat processing unit. The two sheets travel through automatically and emerge from the delivery slot, adhered together, in approximately 8 seconds. The operator simply peels the two sheets apart and has a positive reproduction of the original on the No. 2 sheet; no developing, no fixing, no washing, no drying. Every detail of the original is faithfully reproduced in black and white. The No. 1 sheet can be either thrown away or saved as a reverse reading file copy.

In normal office use, even an inexperienced operator can produce a minimum of 100 Auto-Stat copies per hour. The unit is especially designed to handle letter and legal size copies as well as larger copies up to 11 x 17 inches.

The machine itself is smartly styled and has a gray hammerloid and black wrinkle finish. It measures 21″ long x 8″ wide x 5″ high. It is sturdily constructed of rustproof stainless steel and may be equipped for either AC or DC operation.

Transfer Device Permits Safer Press Work

A new transfer mechanism to index, advance and unload 22-pound brake drums through a 600-ton coining press, has been developed by Sahlin Engineering Company.

The device was designed especially for a leading automotive manufacturer to eliminate danger to the press operator while feeding and unloading. The operator must now place his hand beneath the punch while he is locating the heavy drum properly in the die. Although the brake drum line is geared to operate at a maximum speed of six per minute, the new transfer mechanism can deliver 12 per minute.

TRAUB

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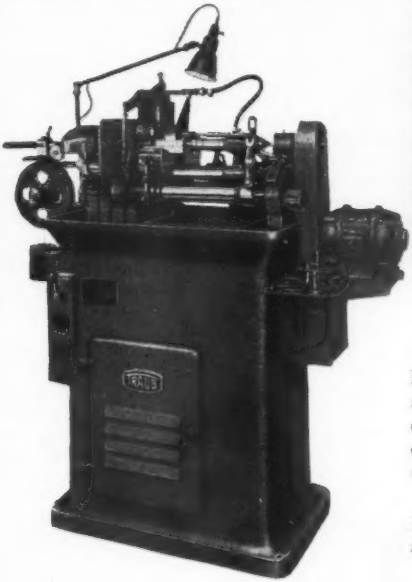
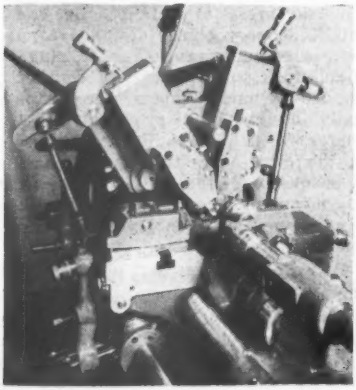
... for High Precision Production ... whether a hundred or a hundred thousand pieces...





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Extremely rigid and accurate ... easily set up ... quick tool changes for 100 or 100,000 pieces. Spare parts and cam blanks carried in stock ... form tool and cam-making service available.

Prices from $2475 . . . financing available.

Model No.	A-15	A-20	A-25	A-36
Brown & Sharpe Spindle Collet	B&S #10	B&S #11	B&S #21	B&S #22-C
Max. Collet Capacity	19/32"	13/16	1"	1-13/32"
Max. Longitudinal Turning Length	3⅛"	3⅛"	3⅛"	3-5/32"
Max. Threading Length	1½"	1½"	1¼"	
12 Spindle Speeds	900/6500	550/4000	550/4000	200/2500
Production Rates	28/3000	28/3000	28/3000	15/1300
Pieces per Hour	in 44 steps	in 44 steps	in 44 steps	in 44 steps

Exclusive U. S. Representatives

GUTHERY MACHINE TOOL CORPORATION

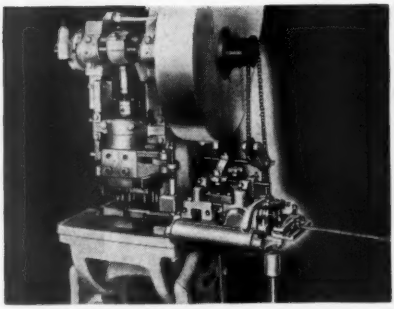
130 West 42nd St. New York 18, N. Y.

. . . Work Handling, from page 108
work being handled.

Those who specialize in providing hoppers for feeding various types of machines can usually supply a hopper or magazine feed suited for press work. There is one round hopper feed for presses, designed for feeding round pieces such as shells and slugs. This particular device is portable, and entirely self contained. Therefore it can be moved from one place to another, or from one press to another. It has a straight delivery chute, designed to provide a constant stream of shells, slugs or similar work to the dies. In connection with use of such hoppers, the customer usually designs and provides his own transfer mechanism, building it directly into the die. A die-transfer mechanism may be operated either from the press ram or by means of an air cylinder. The hopper mentioned above incorporates its own electric-motor drive.

Special Press Feeding Devices

Some manufacturers specialize in problems dealing with press feeding. One special feeder observed is designed for use in feeding square blanks for production of circular armature punchings. The blanks are positively fed. In this case they are 18¾" square, and .017" thick. The feeding device incorporates gripping fingers which hold the blank in place during the punching operation, then pull the scrap out of the press and deposit it underneath the feeder. The circular armature punching, meanwhile, is dropped onto a carry-out basket, which transports it to a conveyor. This conveyor, in turn, carries the punching to a matcher.

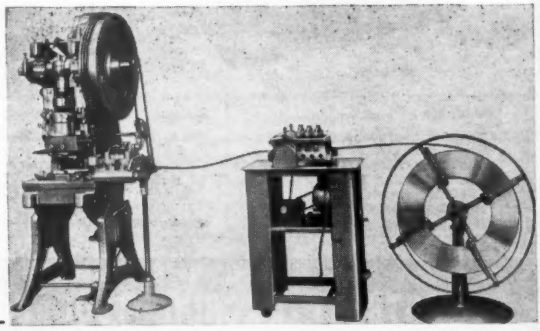


A roll feed of the type driven by sprocket and chain form the press crankshaft. The rolls revolve continuously, but forward movement of stock is arrested momentairly by release of rolls at predetermined intervals.

On most feeders of this type, action of the slide is obtained through a linkage connected to the press ram. However, there are cases in which a stroke longer than can consistently be obtained from a press ram is required. In such instances, an air cylinder may be employed for the purpose. In the case in mind, the air cylinder is operated through a solenoid-controlled valve. The ram of the press trips micro-switches, to maintain proper timing of feed. The feeder in this case is designed to feed up to 30 punchings per minute.

Special gravity-type feeders are often used to advantage in connection with inclined-type presses. Some very fine feeders of this type make use of a shuttle mechanism, which drops a single punching from the bottom of a stack onto a slide. Since this feeder is used with an inclined press,

(Continued on page 131)



Another example of the Wittek chain drive actuated roll feed, with a reel stand at the extreme right for supporting the coil of stock, and a straightener located between the reel stand and the press.

Tracer-Controlled Pantograph cuts and rounds thermal slot in 8-foot steel propeller blade in 40 minutes; previous time was 5 hours, 10 minutes — just one of hundreds of examples of time and cost saving with tracer-controlled Pantograph machines.

Special Machine Tools Speed Production During Rearmament

by
GEORGE GORTON III
Executive Vice-President,
George Gorton Machine Co.

INDUSTRY'S foremost responsibility right now is to produce faster, to highest quality standards and at lower cost — whether on defense contracts or for our civilian needs.

Today, there are literally thousands of operations being performed throughout industry which can be speeded up, improved in quality and lowered in cost by the use of available models of special machine tools. The modern tracer-controlled Pantograph machine is such a tool. It is both a special purpose machine, ideal for short runs, and it is an accurate single purpose machine which turns out identical parts or pieces to meet tight production schedules.

The tracer-controlled Pantograph machine is used for inside and outside profiling, routing, die sinking, mold cutting, counterboring, contour milling, chamfering, grooving, graduating and engraving in ferrous and non-ferrous metals, as well as in plastics.

This machine performs on flat, uniformly curved, cylindrical, spherical or irregular shapes — it works in either 2 or 3 dimensions, in all directions on a horizontal plane, and vertically. It employs enlarged masters, templates or patterns which are quickly and easily made and operates normally at a reduction ratio thereby increasing accuracy — exclusively characteristic of the pantograph.

Single or repetitive accuracy — from one piece to thousands — manual or full automatic operation depending upon quantities — work sizes from the size of a dime to as large as 10 feet.

A new booklet, "Pantography," explains the process and shows what this type of machine can do for you. It is yours without obligation. Write for it today. If interested, also ask for our latest General Catalog 1655. Address the George Gorton Machine Co., 1201 Racine St., Racine, Wisconsin, U. S. A.

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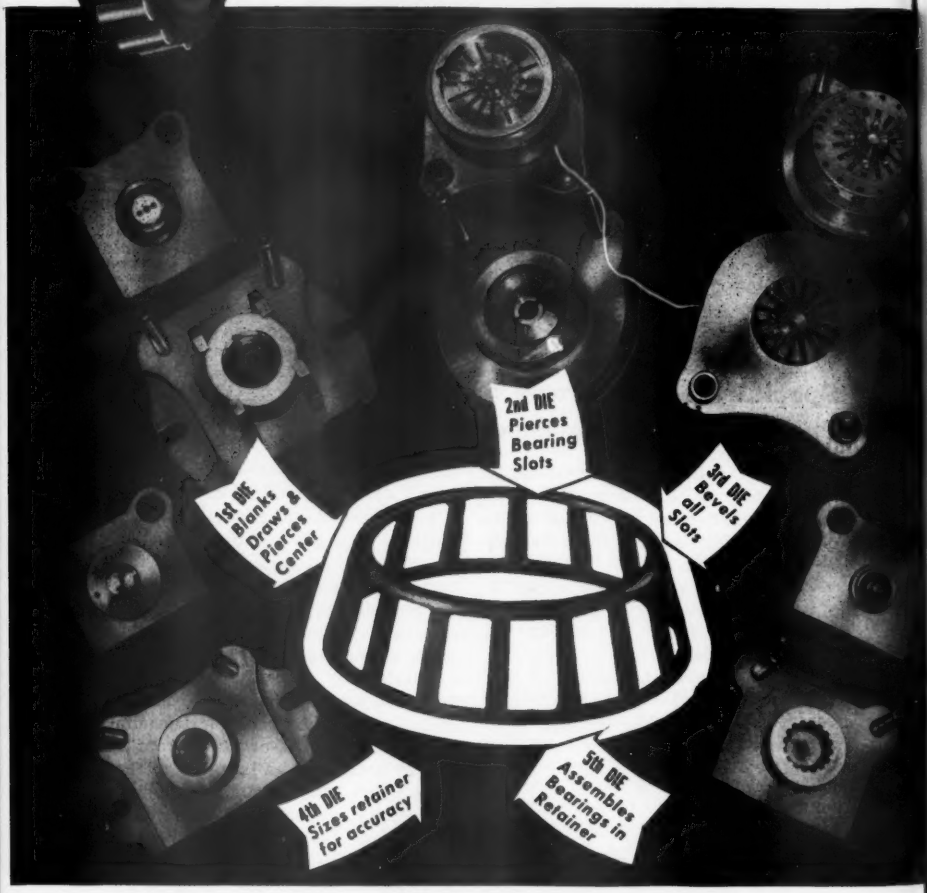
5 BARTH DIES

completely produce roller bearing retainer
and also assemble bearings in the retainer



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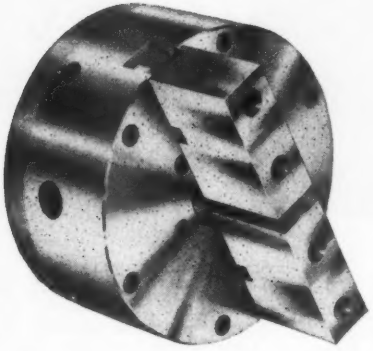
Buck ADJUST-TRU CHUCKS



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The master jaws have *soft* top jaws which you machine to hold your specific work, then harden if you wish. That's not new. But the way the Adjust-Tru principle saves time on accurate rechucking is truly amazing. The jaws move in and out simultaneously to grip the work with a *single-pinion* action — just like any scroll chuck.

You make but one adjustment for precision when you start your run — then re-chuck with scroll chuck speed without further adjustment.

Ask for a catalog with full details.

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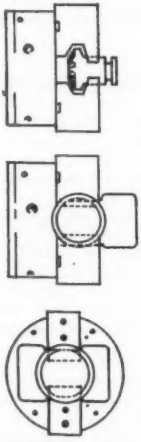

BUCK TOOL COMPANY
118 Schippers Lane
KALAMAZOO, MICHIGAN

SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

"Better Grinding" Booklet Dramatizes Operations

Pictured above is the leatherette cover, together with a pair of typical pages, from Landis Tool Company's new Third Edition of its "Better Grinding" booklet.

This comprehensive, 84-page book, with spiral binding, contains 17 chapters devoted to basic grinding facts as they pertain to any make cylindrical grinder. There are more than 90 practical, cartoon-type illustrations dramatizing various grinding operations.

Valuable tips are included on the following: how to set up grinding jobs; how to operate precision cylindrical grinders; how to take proper care of cylindrical grinders; and how to turn out better grinding jobs.

This publication has been prepared to help train the thousands of new machine operators who have entered industry to assist in the defense program.

★ ★ ★ ★ ★

Alloy Reduction in Engines Is Air Force Goal

The further reduction of high alloys in aircraft engines, partly through the application of high temperature porcelain enamel coatings, is a goal being pursued by both the U. S. Air Force Power Plant and Materials Testing Laboratories at Wright Field, according to an informal talk delivered by Lt. Col. R. A. Jones before the annual meeting of the Porcelain Enamel Institute at White Sulphur Springs, West Virginia.

In describing the turbo-jet engines, he stated that new high temperature porcelain enamels that function at temperatures of from 1600-1800° F. under severe vibration and thermal stress and shock conditions are currently being used widely. These porcelain enamel coatings are for the most part being used to protect a high alloy that is utilized for its high physical properties but a saving is experienced as a result of greatly extended service life. Porcelain enamel coatings such as these are being used, according to Col. Jones, on nearly all sheet metal parts and these include the tail exhaust cones, tail pipes, compression chamber interliners and directive vanes.

Discussing the longe range rockets, he pointed out that temperatures of from 5000-7000° F. are experienced in combination with 200-500 psi compression. Ceramic bodies rather than porcelain enamel are used in these extreme conditions but a large field may be opening up in the porcelain enamel coating of regenerative and cooling portions of the mechanisms. Certain uses were also cited in connection with rocket power plants and aircraft rocket cylinders used in take-off assistance and otherwise.

Possibly the greatest use of porcelain enamel coatings on ordinary steels may fall, Col. Jones said, under the heading of expendable items that must be adequately protected before and during their brief service prior to disposal. The lessons being learned every day, he stated, will surely mean new and better civilian adaptations later.

Superior builds "Tailor-Made" die sets of any size . . . for any purpose. This large 3-pin flat gang bolster (128" long, 21" deep), recently built and machined complete for one of the nation's leading manufacturers.

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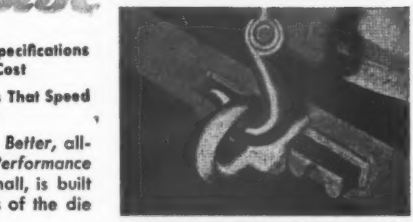

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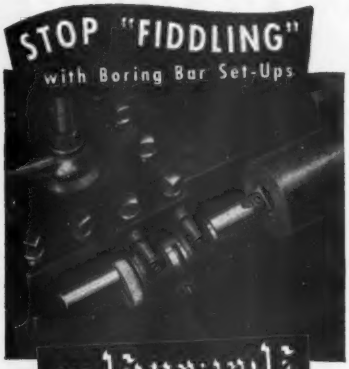

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- Made of tough, durable heat-treated cast steel to rigid specifications.

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2000 North Parkside Avenue
Chicago 39, Illinois

Compressor Housing Gage Computes Average I. D.

A special Air-O-Limit gaging fixture for checking the bores of refrigerator compressor housings has been developed by Pratt & Whitney, Division Niles-Bement-Pond Co. These housings are deep drawn sheet steel. They have an average internal diameter tolerance of .002", and a maximum out-of-round tolerance of 0.15". The gage checks the housing bore for average diameter at several points along the entire length of the internal wall.

The gage has a ball bushing slide on which the housing is located from its outside diameter. This slide is also used to move the housing on and off the gaging plug. The gaging plug has six cartridge-type gaging nozzles that feed from one gaging unit. The amount of air that escapes from these nozzles combines to give an average diameter reading on the indicating meter. (As shown in the picture, the indicating meter is on top of the gage. The dial on the side shows line pressure.)

The indicating meter is calibrated with full scale of .016". This wide range is made possible by the design of the cartridge-type air nozzles.

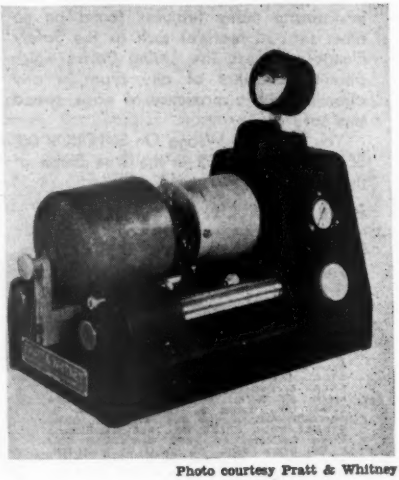

Photo courtesy Pratt & Whitney

. . . Die Casting, from page 102

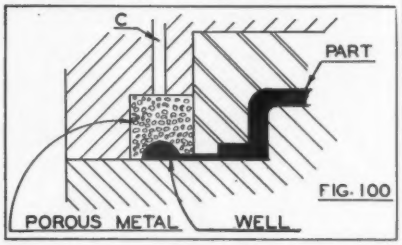

Fig. 100. Overflows may be shaped into blocks of porous metal and set in the die adjacent to the die cavity. Vent C forms a passage for the air to escape from the porous metal overflow as it is forced ahead of molten metal entering the die cavity.

employ two or more parallel vents of smaller width rather than one wide one, Figure 99B. The principal reason for the multiple small vents over one large one is that the locking force exerted on the die is more equally distributed over the die shut-out area.

Figure 99C illustrates how vents "A" and "B" can be lead off of overflows "O".

Porous Metal Vents

Overflows may be shaped into blocks of porous metal which in turn are placed in the die adjacent to the die cavity, Figure 100. The air is then able to pass out of the die cavity, through the overflow channel, and into the overflow where it escapes through the porous metal. The molten die casting alloy of course solidifies in the overflow as it cannot pass through the pores of the porous metal block which is itself exposed on one surface to atmospheric pressure, channel "C", Figure 100. The porous metal block overflow inserts are kept clean by swabbing occasionally with suitable acid.

DETROIT TAP AND TOOL COMPANY, 415 Boulevard Bldg., Detroit 2, Mich., has just competed a new 26,000 sq. ft. factory expansion at Sheboygan, Mich.

The plant represents an addition to the company's facilities in Detroit. It was constructed to take care of the company's increased business on taps, thread gages, thread milling cutters and other threading tools. The company's original plant and general offices will remain in Detroit.

The first machines went into production in the new plant on November 16.

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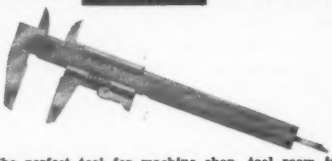
With the AMIC Vernier Caliper



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#22B, Graduation 1/40" and full MM, vernier reading .001 and 1/10 MM.
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. . . Lincoln Electric, from page 68

economies realized. Figures given are based, as far as steel saving is concerned, on only a 4½ cent steel price. If current steel prices, effective in most plants, were used, the savings would be much increased.

In any event the savings are sufficiently impressive to warrant study of similar practice where parallel conditions apply. With bar stock high in price and so short in supply, waste in chips occasioned by machining away much stock should be avoided. Proper use of welding equipment may not always be the answer but the cases cited provide sufficient evidence to show what can be done under conditions of the type outlined.

Fig. 12. Flange as it appears after metal for the boss is welded on and also after this metal has been machined to form the finished boss.

Fig. 11. In this machine, short shafts are submerged arc welded to a flange while both components rotate slowly below the arc.

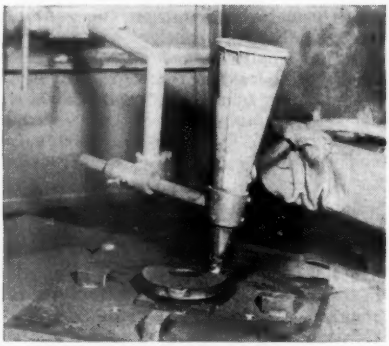

Fig. 13. Depositing weld metal to produce an annular boss on the outer face of the flange. Formerly the flange was thicker and the boss was machined with considerable loss in chips.

★ ★ ★

Casting Design Contest Winners

Winners of the Meehanite Casting Design Contest have been announced by The Meehanite Metal Corporation, New Rochelle, N. Y. This contest, open only to design engineers in manufacturing plants using castings, was aimed toward uncovering facts about new uses and applications of Meehanite castings, and uncovering problems solved by their specifications.

The prize winners, prizes and titles of the winning entries are as follows:

FIRST PRIZE, $500: H. D. Samuel, Jr., McCulloch Motors Corp., Culver City, Calif.—"Airborne Compressor Castings."

SECOND PRIZE, $300: William H. Thomas, Roots-Connersville Blower Corp., Connersville, Ind.—"Compressor Castings."

THIRD PRIZE, $150: Al Gorski, George Gorton Machine Co., Racine, Wis.—"Special Pantograph Machine."

FOURTH PRIZE, $100: Henry Hubbell, Fafnir Bearing Co., New Britain, Conn.—"Railway Journal Housing."

FIFTH PRIZE, $75: Robert E. Greenawalt, Salem Engineering Co., Salem, Ohio—"Heat Treating Furnace Parts."

SIXTH PRIZE, $50: Max M. Beasley, Cobble Brothers Machinery Co., Inc., Chattanooga, Tenn.—"Rug Sewing Machine."

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64 DRAWER	32 DRAWER	24 DRAWER	16 DRAWER	12 DRAWER	8 DRAWER
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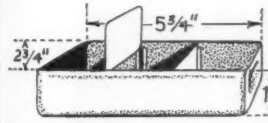

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18% Nickel-Silver Alloy Solves Machining Problem

Metallurgists and engineers concerned with the specifying of materials for some of today's tricky machining jobs may be interested in a problem recently served up to Theo. Alteneder & Sons, manufacturers of high quality drafting instruments.

A government contract called for special 12″ scales, engine-divided into graduations of .01″. Alteneder had made similar scales, using a variety of materials, but in all previous cases, only the first inch was marked off in .01″ graduations. Twelve full inches to be so divided produced an unusual manufacturing problem.

Stainless steel, desirable due to its durability, caused considerable difficulty in trial runs, not only during machining the basic strip, but also in cutting the 1201 channels (or grooves) required. Each cut is about .005″ deep, and one groove is required at each graduation.

Alteneder specified a free-cutting 18% nickel-silver alloy, Riverside Metal Company Mixture No. 5. This mix nominally contains 65% copper, 18% nickel, 16% zinc and 1% lead. The lead additive gives

Photo courtesy Riverside Metal Co.

the material a relative machinability rating of 50, which compares with a rating of 20 for the unleaded alloys, and 100 for free-cutting brass.

Riverside Mixture No. 5 has been found to be a "happy medium" from several standpoints including the elimination of burrs resulting from the tiny, closely-spaced cuts.

Further, the 18% nickel alloy has a desirable light color, a low coefficient of linear expansion (.0000090 per °F.), and good durability; factors of importance for the mapping and survey work for which the scale is used.

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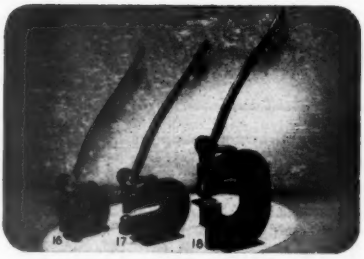
Roller bearing, lever-type punches specifically designed for bench use. The powerful No. 18 has a higher and deeper throat than Nos. 16 and 17; is an ideal tool for punching holes close to the web of an angle. Removable and adjustable die shoes of the No. 18 permit use of close-fitting punches and dies. Work tables are available for all models.

	No. 16	No. 17	No. 18
Capacity—Mild Steel	3/8″ thru 1/4″	1/4″ thru 1/4″	13/16″ thru 12 ga.
Throat Depth	3 1/16″	6 1/16″	7″
Throat Height	9/16″	1 1/16″	5″



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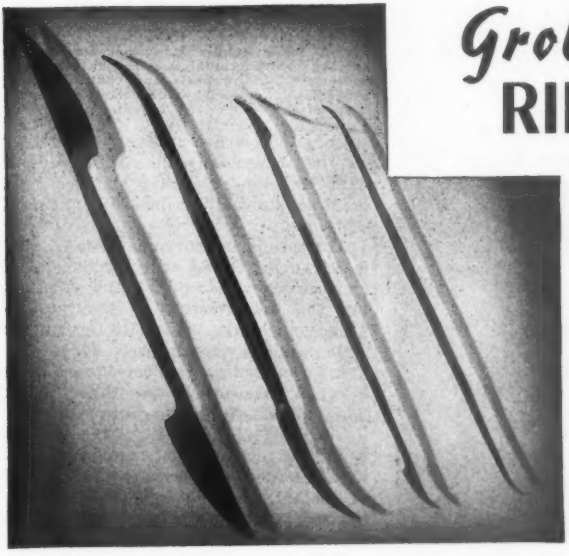

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Gear Hobber Improvements Save Setup Time and Reduce Production Costs

Extension of tool life and the reduction of setup time are universally recognized as means for cutting production costs. This is emphasized by the addition of two time saving components to the gear hobbing machine built by one manufacturer, which shows the importance of these characteristics, despite the fact that the machine has been successfully used without them since it was first introduced.

Users and builders of small precison assemblies which incorporate spur, spiral or crown gears, worms or worm gears or gear segments will be interested in the two recent improvements developed for the Hamilton No. 1 Gear Hobber, which is widely used for the generation of such small precision gears.

The first, shown at "A" Figure 1, is a vernier to measure minutes of the degrees on the turntable scale. The added ease with which accuracy is attained at this point substantially reduces setup time and costs.

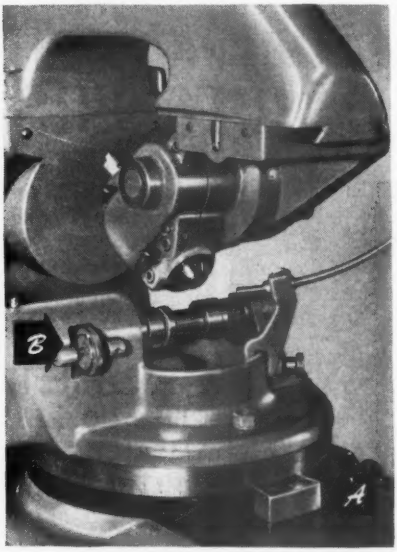

Fig. 1. Close-up of Hamilton Hobber turntable scale showing the vernier "A" which has been added to this machine. The vernier divides degrees into minutes for greater accuracy and a saving in setup time.

The knurled thumb wheel shown at "B" provides an accurate and rapid means of positioning the hob relative to the work.

Photos courtesy The Hamilton Tool Company

Fig. 2. The hobber is shown mounted on a cabinet which contains some of the control equipment. Handwheels and control levers are conveniently located within easy reach of the operator.

The second improvement, shown at "B," is a knurled thumb wheel which provides an accurate and rapid means of positioning the hob relative to the workpiece. This device also helps to speed setup, and provides the further advantage of greatly extending the periods of hob use between sharpenings and thus increasing hob life and further reducing costs.

Worthy of mention is the fact that Ruthman Gusher Pumps are now used on the Hamilton Hobber for the circulation of coolant, and the further fact that the hobber's coolant system is now operated through controls independent from other working parts.

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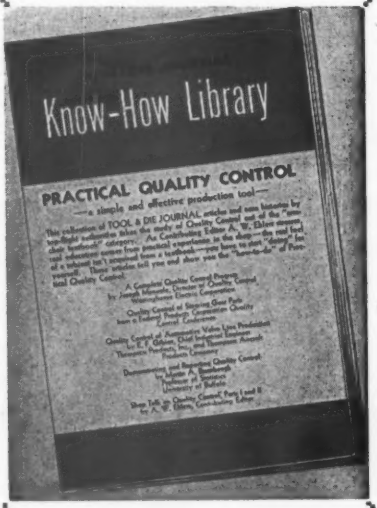

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Dollar Savings Through Standards in the Machine Tool Industry

The value of standardization in the machine tool industry is emphasized in the first comprehensive survey made of the savings effected in American industry by the use of standards.

Entitled "Dollar Savings Through Standards," the 32-page survey has been released by the American Standards Association as a service to American industry. It consists of 140 case studies covering 81 industries and industrial products. Eight of the case studies are in the machine tool field.

Some 2100 company members of the Association were enlisted to supply the information from their own standardization experiences and techniques. The result is the first body of measurable proof in terms of dollars or percentage of net savings and specific economic benefits attributable to standardization.

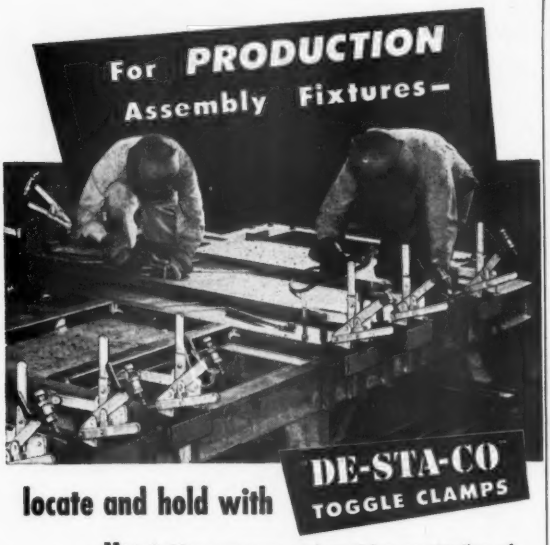
European field teams of the Economic Cooperation Administration are using the survey now as documentary evidence of what standards can do for the company that uses them. It is hoped that manufacturers in the Marshall Plan countries can be induced to accelerate the application of standardization in order to speed military preparedness and economic self-dependence abroad. The data for the study were assembled by the American Standards Association at ECA's request.

The survey reveals a sharp rise in the use of standards since the war, particularly in the past two years. Company after company refers to recently installed standards programs, while others speak of programs not yet completed or those about to be started. Several machine tool builders mentioned in the survey, however, stress that their savings from standardization began many years ago.

Some replies cited specific instances of savings in physical resources, manpower, time and money effected by use of standards. Others stated that standardization procedures are so thoroughly incorporated in their regular operations that it is literally impossible to measure the economic benefits that resulted.

A large machine tool builder wrote:

"We operate a modified lot-repetitive production control system. This method permits the periodic passage of large lots to finished



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stores. We employ the principles of mass production and interchangeable manufacturing as far as they prove economically sound. Naturally, with small lots, much of our shop time is spent for setup work and, therefore, less time is available for actual machining. We endeavor in all cases to use the standardization-of-parts principle in order to increase the quantity of the lots in the shop and to reduce the over-all number of parts to be fabricated.

"I am enclosing a service manual on our vertical turret lathe line which is in great demand, especially in the aircraft field. . . . I believe this manual is self-explanatory and will demonstrate how we have followed our practice of standardizing parts for our machine.

"We also make use of industry standards whereever possible and we have in our plant a manual which we call our 'Style Book,' which lists standardization of miscellaneous parts which are used on a wide variety of our products."

From another company, which manufactures large quantities of mechanical fasteners, came this letter:

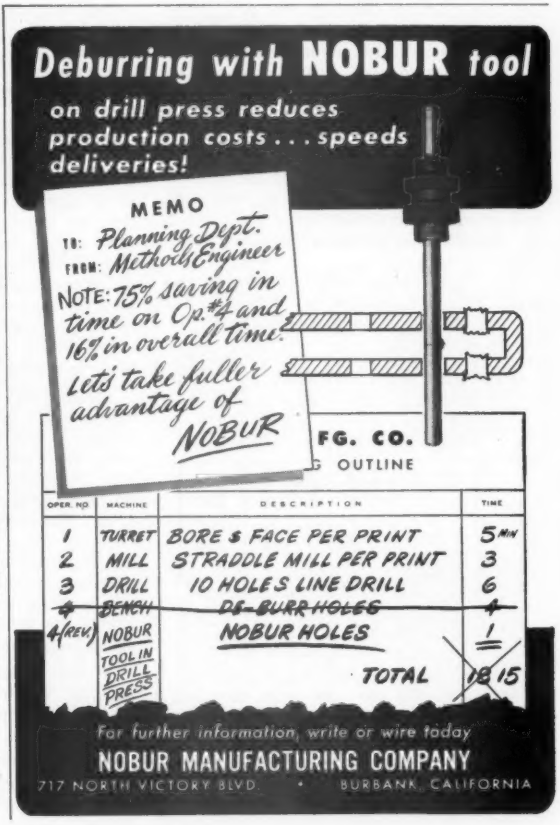
"There is no doubt in my mind that the savings have been enormous through standardization of bolts and nuts, not only in the bolt and nut industry, but to the entire country. This is so generally well known and accepted throughout our organization that whenever we receive a request from a customer for an item other than standard, we almost always try to get the customer to accept a standard product.

"In our own purchasing, wherever possible, we try to purchase standard items, avoiding specials as much as we can."

Among the replies to the questionnaire, which told of instances where use of standards could effect savings was one that emphasized the importance of the recent adoption of four shades of gray finishes as standard for industrial apparatus and equipment (American Standard Z55.1-1950).

"A $25,000 machine tool waited four weeks for a can of paint so that it would match other tools in the factory of the same purchaser. The interest charge alone amounted to $125."

Copies of the survey booklet can be had from the American Standards Association, Inc., 70 East 45th Street, New York 17, N. Y. ECA is distributing the report abroad; in the United States copies can be procured only through ASA.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. . . Stainless Steels, from page 56

TABLE III. ANNEALING PROCEDURE FOR FERRITIC STAINLESS STEELS (1)

Type A.I.S.I.	Annealing Temperature Range, deg. Fahr.	Time*	Quench	Hardness	
				Brinell	Rockwell
405	1200 to 1500	1 to 2 hrs.	Air	140 to 165	B77 to B85
430	1400 to 1525	1 to 2 hrs.		140 to 165	B77 to B85
430F	1200 to 1450	1 to 2 hrs.	or	165 to 190	B85 to B91
442	1400 to 1525	1 to 2 hrs.		150 to 175	B80 to B88
446	1400 to 1525	1 to 2 hrs.	Water	160 to 185	B84 to B90

*For sheet and strip work, hold at temperature 3 minutes for every 0.100 inches of thickness.

ture of between 1850° and 1900° F. will give maximum surface hardness. The quenching temperature rises with increasing carbon, thus in the 440 series a quenching range of from 1850° to 1950° F. is usually recommended.

The "as quenched" values as given by Armco[3] are shown in Table VI along with the recommended quenching temperature. The high side of the recommended hardening range will result in maximum hardness and toughness after stress relieving, whereas the low side will produce maximum toughness when the material is tempered after quenching.

The time factor will vary with the load; this usually being a matter of both judgment and experience. A fifteen minute soaking period is usually adequate for small parts; this time being increased to approximately one-half hour for large sections. Prolonged soaking will not increase the quench hardness but may be detrimental in that both decarburization and grain growth may occur.

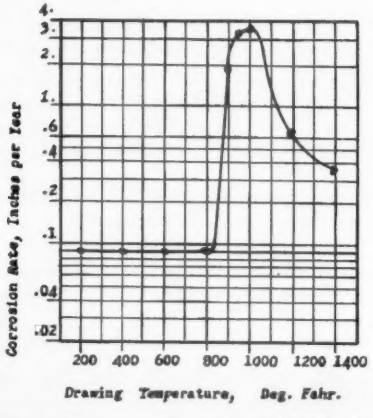

Fig. 5. This curve shows the relationship between tempering or drawing temperature and corrosion resistance for a type 410 stainless steel.

Either oil or air quenching can be employed; the latter being the preferred where irregular or sharp filleted sections are quenched and either distortion or cracking of the hardened part may result by employment of a more drastic quench. Where it is permissible, oil quenching is often chosen due to the slightly higher hardness values that are obtained. Water quenching is not recommended due to the propensity toward quench cracks.

Those stainless steel compositions are represented by types 501 and 502 are generally classified within the stainless steel grouping, even though the chromium content is much lower than the normal types of stainless steel encountered. These compositions can be hardened by the usual heat and quench; the development of these alloys being primarily for the oil refinery industry where they are used in the form of tubing or tubular products in the fully annealed condition.

Within these compositions, additional alloying elements such as molybdenum (0.40/0.60 percent) and tungsten (0.75/-1.25 percent) are added to eliminate temper brittleness and increase to a considerable extent the physical properties of the composition at elevated tempera-

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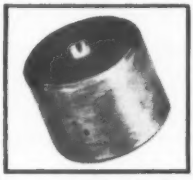

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tures.

Although the austenitic stainless steels are not normally hardenable by a heat and quench treatment, work has been done to develop a precipitation hardening alloy combining the excellent corrosion resistance of the chromium-nickel alloys with the high elastic and strength properties of a hardened alloy.

One of the first types of alloys developed was stainless 'W' which had an approximate composition of 0.07 precent carbon, 0.50 percent manganese and silicon, 0.010 percent of sulfur and phosphorous, 7.0 percent nickel, 17.0 percent chromium, 0.70 percent titanium and 0.02 percent aluminum. Hardness values of as high as C47 were obtained by a combination of solution treatment and aging.

Recently, Goller and Clarke[3] published an article where two chromium-nickel precipitation hardening alloys were discussed. These alloys are known as Armco 17-4 PH and Armco 17-7; the former having copper as the precipitation hardening element whereas, the latter employs aluminum neither of which are carbide forming elements. A precipitation hardening temperature of 900° F. is used for alloy 17-4 PH which obviates cracking, distortion, decarburization, scaling or similar problems encountered in high temperature heat treatment. Overaging occurs rapidly at 950° F. and higher. Typical physical

TABLE IV. AVERAGE RESULTS OF TEMPERING FULLY HARD MATERIAL (1)

Type	Hardness Range		Average Mechanical Properties				
	Brinell	Rockwell	Ultimate Tensile Strength psi	2% Yield Strength psi	Elongation in 2 inches, %	Reduction in Area, %	Izod Impact Range, Ft. Lbs.
1000 Deg. Fahr.; 4 Hrs.							
410	260/330	C25/C34	145,000	115,000	20	65	35/70
403	260/330	C25/C34	145,000	115,000	20	65	35/70
416	260/330	C25/C34	145,000	115,000	16	53	10/30
431	270/340	C26/C35	160,000	125,000	17	55	35/70
1100 Deg. Fahr.; 4 Hrs.							
410	210/250	B95/B100	115,000	90,000	22	65	65/90
403	210/250	B95/B100	115,000	90,000	22	65	65/90
416	210/250	B95/B100	115,000	90,000	18	53	20/35
414	250/290	B100/C29	135,000	110,000	20	60	25/40
431	245/285	B99/C29	130,000	100,000	18	58	45/80
1200 Deg. Fahr.; 4 Hrs.							
410	200/230	B93/B97	105,000	85,000	23	67	85/110
403	200/230	B93/B97	105,000	85,000	23	67	85/110
416	200/230	B93/B97	105,000	85,000	19	55	30/45
414	245/265	B99/C26	125,000	100,000	19	60	30/60
431	230/260	B99/C24	120,000	95,000	19	60	55/80
1300 Deg. Fahr.; 4 Hrs.							
410	195/220	B92/B96	100,000	80,000	25	69	90/110
403	195/220	B92/B96	100,000	80,000	25	69	90/110
416	195/220	B92/B96	100,000	80,000	21	57	35/60
414	240/255	B99/C24	120,000	95,000	20	62	55/80
1400 Deg. Fahr.; 4 Hrs.							
410	170/195	B86/B92	90,000	65,000	27	67	95/115
403	170/195	B86/B92	90,000	65,000	27	67	95/115
416	170/195	B86/B92	90,000	65,000	25	60	50/70

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. . . Work Handling, from page 112

gravity carries the punching into the nest of the die after it has dropped on the slide.

Swing Back for Die Changes

Feeders of this type are quite light in weight and are designed to swing away from the press as necessary to facilitate die changes. They can be installed within an inch of the press crosshead. In this case, the shuttle mechanism is actuated by a cam roller, which is fastened to the crosshead of the press. The cam is adjustable to suit sheet height. This makes it possible to time the release of the punching just before the bottom dead center, or on the upward movement of crosshead. Timing in this manner provides sufficient time for gravity delivery and settling of the punching in the die nest. Once the timing is properly set, there is no deviation, and no danger of die breakage.

One remarkable type of press feeder, often manufactured to meet specifications, permits full-speed capacity of presses to be utilized in producing laminated products. This particular feeder inserts blanks and also removes punchings by positive action. Gravity is not depended on for removal of punchings from the die. For example, where motor laminations are being produced, the rotor disc is punched through the die to a stacking tube, and the stator punching is pulled back out of the die with the feeder slide and then dropped on to a conventional matcher. Feeders of this kind may be swung aside easily and quickly when necessary to make die changes. Using them, it is not possible to feed two or more punchings into a die at one time. Neither can parts be stacked in the die. Therefore, need for overload safety precautions is eliminated.

The speed of such feeders is controlled directly by speed of the press. They will operate up to 150 strokes per minute with mechanical linkages. It is believed that through utilization of air linkages, even higher speeds could be obtained from such a feeder. This particular type of feeder has been developed to handle electric motor laminations, but we believe it has numerous applications, wherever blanks are fed into dies, and production speed is limited by the feeding mechanism.

(To be continued)

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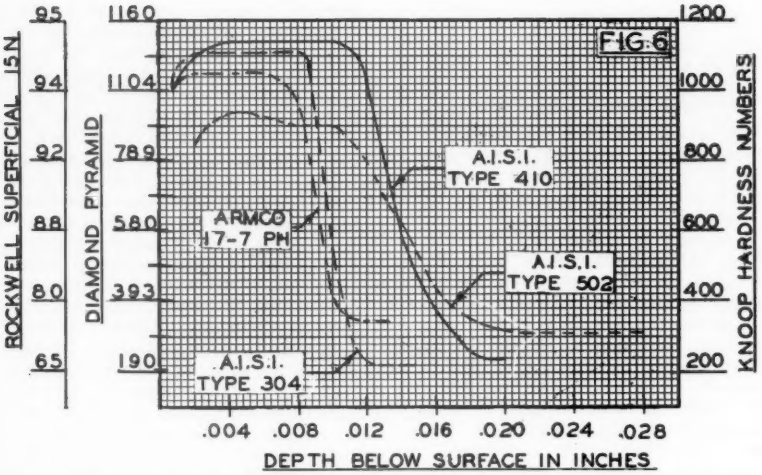

Fig. 6. Along with efforts to increase wear resistance, some reduction in corrosion resistance is encountered. These curves show hardness vs. case depth for four types of stainless. Values determined by Low[4].

properties are listed in Table VII.[3]

Armco 17-4 PH was principally developed for bar and forging billet application. Armco 17-7 PH has been developed for sheet, strip, plate and wire applications; this alloy containing approximately 0.07 percent carbon, 17.0 percent chromium, 7.0 percent nickel and 1.0 percent aluminum. The two heat treatments that are required to harden this material to a range of 40 to 45 Rc are: (1) 1400° F. for ½ to 3 hr., then water quench or air cool, and (2) 900° to 950° F. for ½ to 1 hr. and then air cool. After the intermediate 1400° F. treatment the hardness is between 26 and 30 Rc.

In the event that the martensitic stainless steels are subjected to a hardening treatment, stress relief or a tempering draw should immediately follow; this being particularly true of the high carbon stainless grades such as type 420 and the 440 series since maximum corrosion resistance is realized when the material is in the hardened and stress relieved condition. The stress relief treatment should follow hardening immediately; the temperature usually employed varying from 300° to 700° F. The lower side of the range is used where maximum hardness is desired; the middle of the range is used where

(Continued on page 150)

TABLE V. HARDNESS VALUES. 13/32" DIAM. TEST BAR.

Quenching Temperature, deg. Fahrenheit	Type 410 Stainless		Type 420 Stainless		Type 440A Stainless	
	Oil Quench	Air Quench	Oil Quench	Air Quench	Oil Quench	Air Quench
1700	C42.5	C41.5	C43/C45	C47	C45/C47	C44/C46
1750	C43.5	C42.0	C46/C48	C48/C50	C48/C50	C47/C51
1800	C43.0	C39.0	C47/C51	C48/C50	C46/C52	C49/C51
1850	C42.0	C38.0	C50/C51	C49/C51	C51/C53	C51/C52
1900	C40.0	C34.5	C48/C51	C50/C51	C52/C54	C52/C54
1950	C38.5	C34.0	C46/C49	C47/C48	C53/C55	C53/C55

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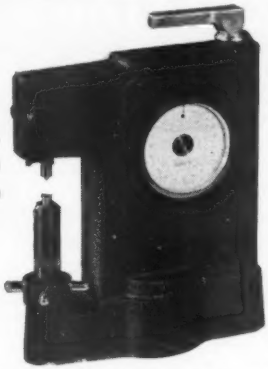

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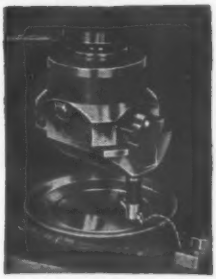

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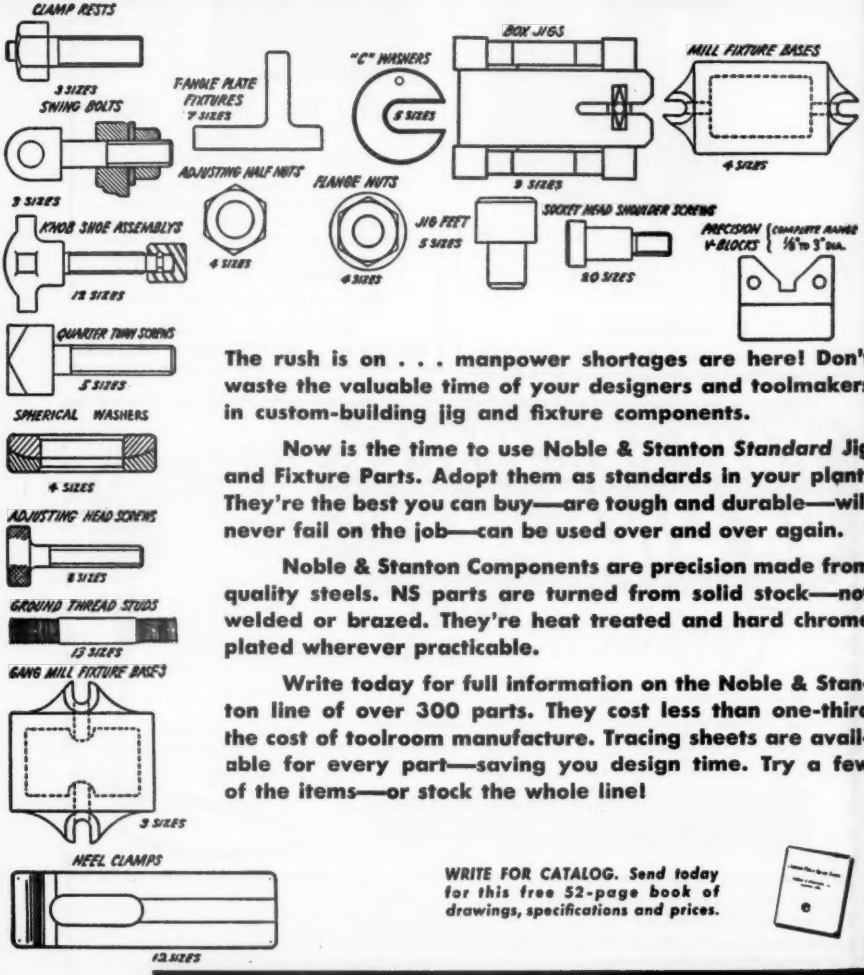

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A4	A15	A26	B9	B20	B31	B42	B53	B64	B75	C1	E2	E13	E24
A5	A16	A27	B10	B21	B32	B43	B54	B65	B76	C2	E3	E14	
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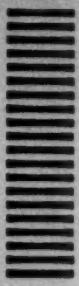

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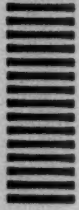

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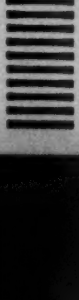

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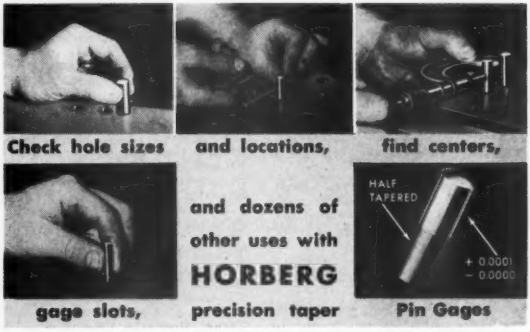
INFORM-A-GRAM KEY NUMBERS

PUBLICATION

Keep Informed! CATALOGS • BULLETINS • SPECIFICATIONS

"John's" Drill Jigs shorten setup time, save on tooling costs and speed up production on many drilling, tapping, boring, milling and grinding operations. They are made by Heuser Mfg. Co. in three standard sizes: 6", 8" and 14". Descriptive literature is offered.
Inform-A-Gram No. B1.

"Service in Stampings," is a well-illustrated, 12-page booklet giving stampings purchasers such information as will assist them in preparing specifications that will insure lowest possible quotations. LAMINATED SHIM CO., 85 Union St., Glenbrook, Conn.
Inform-A-Gram No. B2.



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..... Number Sets @ $90. 120 gages (1 to 60)
..... Single gages @ $ 1.
..... Stand alone @ $10.

Please Rush checked items and literature to
company
address
name
title

Hydraulic Broaching Machine. Acme Broach Corp. has released a descriptive brochure on its new Model U-31 vertical hydraulic broaching machine. This 3-in-one machine employs multiple slides grouped around and operated by a single central hydraulic cylinder, facilitating the use of a single drive motor and hydraulic circuit. In addition to being used for surface broaching work, this same machine can also be supplied for internal push or pull broaching. Illustrations and specifications are included in the brochure. ACME BROACH CORP., Dept. T&P, Milan, Mich.
Inform-A-Gram No. B3.

An Expanded Line of Diamond Grinding Wheels is described in Wickman's new 24-page, two-color catalog. Included are resinoid-bonded diamond wheels, steel-bonded diamond wheels, steel-bonded chip breaker wheels, and both resinoid-bonded and steel-bonded hand hones. Address WICKMAN MFG. CO., 15533 Woodrow Wilson Ave., Detroit 3, Mich.
Inform-A-Gram No. B4.

Precision Small Tools for instrument builders and precision machinery makers are covered in R. Y. Ferner's catalog and price list. Drills, counterbores, reamers, taps and dies, and end mills are among the tools described and priced. THE R. Y. FERNER CO., INC., 110 Pleasant St., Malden 48, Mass.
Inform-A-Gram No. B5.

PREVIEWS

Circle postage-free Inform-A-Gram Key Number for your request

The Improved Precision Lever-Type Drawbar is presented in a brochure from General Die and Stamping Co. The patented co-ordinated cam principle reduces friction to a minimum, eliminates the need for fingers, and its design simplification results in fewer parts to wear out. This drawbar converts a bench lathe into a high speed, hand-type production screw machine. Also described in this brochure are the Klutch-Kollet (step collet chuck), collets and feed fingers. GENERAL DIE AND STAMPING CO., 264 Mott St., New York 12, N. Y.
Inform-A-Gram No. B6.

Metalometer with Peabody Anvil. Peabody Industries, Inc., has issued a new folder describing this pocket-size, surface hardness instrument and anvil. Small metal parts, sheet and strip stock can be held rigidly in the anvil to maintain uniform testing conditions. Features, illustrations and current prices are included. PEABODY INDUSTRIES, INC., 12129 Hamilton Ave., Highland Park 3, Mich.
Inform-A-Gram No. B7.

Flexible Shaft Machines. Foredom's Electric current Catalog 180-1 shows a complete line of machines for every "small-work" job of grinding, finishing, deburring, etc. Included in this eight-pager are descriptions, illustrations and prices of heavy duty, intermediate and light-duty models.
Inform-A-Gram No. B8.

Aba Precision Surface Grinders are presented in a current catalog sheet. The literature contains dimensions, weights and other information on these outstanding machines. AMERICAN MEASURING INSTRUMENTS CORP., 21-25 44th Ave., Long Island City 1, N. Y.
Inform-A-Gram No. B9.

Jiffy Padded Shipping Bags simplify packing, cut costs and safeguard merchandise. They are made from strong, moisture-resistant kraft with built-in "expansion" cushioning. Free samples are obtainable from JIFFY MFG. CO., Dept. T&P, Hillside, N. J.
Inform-A-Gram No. B10.

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on Zagar collet, holding and indexing fixtures. No. 2 W. & S. and 5-C collets are on our shelves — to fill your order *immediately*. Fast service, too, on Zagar air-operated holding fixtures and collet lathe chucks.

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ZAGAR TOOL, INC.

24000 LAKELAND BLVD. • CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

New Type of Tap Catalog. Instead of a single listing for each basic type and size of standard tap, a new 36-page Detroit Tap booklet lists the specific standardized taps available under each of six specific groups of materials for which it is specifically designed. Included are listings of taps for the following: steel and other tough materials; cast iron; aluminum, magnesium and other light materials; zinc die-cast metals; brass; and plastics. DETROIT TAP AND TOOL CO., 415 Boulevard Bldg., Detroit 2, Mich.
Inform-A-Gram No. B11.

Copies of Latrobe's Valuable Tool and Die Steel Manual are still available from the manufacturer. This handy, pocket-size reference book gives 86 pages of information on analyses and properties, recommended heat treating, typical applications, etc. Index tabs are included to permit easy selection of any of the variety of steels produced by Latrobe Electric Steel Co.
Inform-A-Gram No. B12.

The Lodge & Shipley Duplicator is now being distributed by Tracer Control Co., according to a new bulletin that describes automatic contour machining with this duplicator. Outstanding features are detailed and applications for tool and die work, production work and ordnance work are illustrated and described. TRACER CONTROL CO., 595 E. Ten Mile, Box Q, Hazel Park, Mich.
Inform-A-Gram No. B13.

American Drill Bushing Co., Inc., has published a new catalog and price list showing types and sizes and including handy technical information.
Inform-A-Gram No. B14.

Lepel High Frequency Induction Heating Units can perform the following jobs quickly and well at low cost: hardening, brazing, melting, soldering, annealing, stress relieving, normalizing and preheating. A detailed catalog has been released.
Inform-A-Gram No. B15.

Over 305 Standard Fixture Parts and fittings are made by West Point Mfg. Co. This wide variety of types and sizes makes it easy to use Wespo parts for almost all fixture needs. Template drawings of all parts and a descriptive catalog are available.
Inform-A-Gram No. B16.

A Dependable Stamping Service for small quantity requirements for new developments and production up to 50,000 pieces is offered by Small Lot Stamping Co. Details are obtainable from the Linden, N. J., firm.
Inform-A-Gram No. B17.

Jig and Fixture Template Sheets. The latest catalog of Jergens Tool Specialty Co. features 54 pages of full-scale template drawings of standard jig and fixture parts made by this Cleveland firm.
Inform-A-Gram No. B18.

Model A Power Screwdriver, the DPS Hopper Unit and the new DPS Nut Driver are among the power-driven production aids described in the 40-page catalog of Detroit Power Screwdriver Co.
Inform-A-Gram No. B19.

Newman Speed Reducers are presented in a set of illustrated catalog sheets. Instructions on how to attach a Newman Speed Reducer to a drill press are included.
Inform-A-Gram No. B20.

Reinforced Resinoid Abrasive Products are described in Bay State's latest catalog. Detailed descriptions, prices and illustrations are given for: BAYFLEX Reinforced Disc-Wheels, Straight Wheels, Mounted Wheels and Mounted Points; SAF-T-CUT Reinforced Disc-Wheels and Straight Wheels; and DURACUT Abrasive Discs. The "what, how and where" of these "flex" products are shown in an extensive, two-page comparison chart. It covers construction, abrasives, grit sizes, structures, speeds, etc. Write for this informative catalog to BAY STATE ABRASIVE PRODUCTS CO., 1 Union St., Westboro, Mass.
Inform-A-Gram No. B21.

The Advantages of Low-Temperature Metal Treatment are detailed in an eight-page folder by Sub-Zero Products. Among the processes covered are low temperature chilling for stabilization of steel, increasing perishable tool life, and shrink-fit assembly. Write for a copy of "Put Sub-Zero to Work" to SUB-ZERO PRODUCTS MFG. DIV., Deepfreeze Distributing Corp., 3928 Reading Rd., Cincinnati 29, Ohio.
Inform-A-Gram No. B22.

The Timken Graphitic Tool Steel Data Book, now in its ninth edition, provides 48 pages of valuable photos and data on heat treatment, applications, physical properties and machinability.
Inform-A-Gram No. B23.

Hammond Wide Swing (Up to 36" Between Wheels) Grinders are designed for continuous, heavy-duty grinding. Complete details are obtainable from Hammond Machinery Builders, Inc.
Inform-A-Gram No. B24.

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SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

Meyco Carbide-Inserted Drill Jig Bushings combine the best features of steel and carbide; namely, the protection of steel with the long life of carbide at the point of wear. Catalog No. 17 has complete details along with a current price list.
Inform-A-Gram No. B25.

Hand-Cut Steel Stamps —letters and figures—are included in the line of marking devices described and pictured in Hoggson & Pettis Mfg. Company's most recent catalog.
Inform-A-Gram No. B26.

Improved Features of the Procunier High Speed Tap Head are outlined in an illustrated brochure. These include heat-treated gear mechanism for long, trouble-free life; and ball bearings for lifetime accuracy. Specifications and prices are listed.
Inform-A-Gram No. B27.

The Adjustable Rod Guard for power presses is one of the complete line of guards shown in the latest catalog of Humm Safety Equipment Co.
Inform-A-Gram No. B28.

YESTERDAY'S PIONEER . . . TODAY'S LEADER

NEW

HEAVY DUTY END MILLS and HOLDERS

(Both are Stock Items)

● Look at this rugged 2″ diameter Weldon end mill with 4″ long flutes which made a 2½″ deep cut in a solid block of die steel—4140 steel heat treated to 260 Brinnell. The feed was 1½″ per minute, and the material was removed at a rate of 7½ cubic inches per minute.

This HEAVY DUTY Weldon end mill is held by a new-style end mill holder which bolts securely on to the nose of the milling machine spindle. The holder, located by a centering plug, is driven by two drive keys on the spindle nose. The 2″ diameter shanks of these heavy-duty end mills are securely held by two large hollow head screws.

For top performance and sturdy long life in end mills—large or small—look to Weldon.

Weldon distributors throughout U.S.A. and Canada carry complete stocks to serve you.

SEND FOR LATEST CATALOG NO. 10

THE WELDON TOOL CO. Cleveland 4, Ohio

3000 WOODHILL ROAD

Specially Developed Arbor Presses now augment Benchmaster's line of punch presses and milling machines, according to newly released literature. They offer the user increased work capacity —both in throat depth and in vertical space. Numbers 0, 1 and 2 are in standard and solid platen types with choice of lever or pilot wheel actuation. Construction details, specifications and prices can be found in the literature. BENCHMASTER MFG. CO., 1835 W. Rosecrans Ave., Gardena, Calif.
Inform-A-Gram No. B29.

An Illustrated Cutting Tool Chart (14″x14″) is now available from Severance Tool Industries Inc. It illustrates tools representative of the Severance line. It will go out to all T&P readers who request it, in a sturdy mailing tube, tinned top and bottom, unfolded, with hangers attached — ready for shop or office posting. SEVERANCE TOOL INDUSTRIES INC., 730 Iowa St., Saginaw, Mich.
Inform-A-Gram No. B30.

The Ferner Dwarf Brinell Press Portable Hardness Tester (universal type) is the subject of a detailed new catalog. This tester can be used for accurate Brinell tests or for exact calibration of laboratory outfits. Write to THE R. Y. FERNER Co., INC., 110 Pleasant St., Malden 48, Mass.
Inform-A-Gram No. B31.

Carbide Roughing and Finishing are available to every shop through the low-cost Roto-Master Hi-Speed Grinder. This grinder's "super cooling" system permits an operating speed of 38,000 rpm. Master Appliance Manufacturing Co. will furnish literature.
Inform-A-Gram No. B32.

Advantages of Automatic Unloading of power presses with the Sahlin "Iron Hand" are described and pictured in a new eight-page catalog. Three sizes to suit large, medium and small presses are available. Illustrations show how the "Iron Hand" can be adjusted to different widths, heights, jaw travel and distance and angle of swing. Complete installation and operation instructions and a parts lists are included. SAHLIN ENGINEERING CO., 267 Ferndale St., Birmingham, Mich.
Inform-A-Gram No. B33.

Columbia Power Press Brakes, in capacities of from 120 to 1000 tons, for forming mild steel from 3/16" to 1" thick, 6 to 20 ft. long, are presented in illustrated Bulletin 107. Design features and accessory equipment are described, and specifications for all models are listed. COLUMBIA MACHINERY AND ENGINEERING CORP., Dept. T&P, Hamilton, Ohio.
Inform-A-Gram No. B34.

A Unique Non-Ferrous Metalometer is introduced in new literature from Peabody Industries, Inc. This pocket-size, precision instrument permits the recording of accurate, instant non-ferrous surface hardness values on the job. PEABODY INDUSTRIES, INC., 12129 Hamilton Ave., Highland Park, 3, Mich.
Inform-A-Gram No. B35.

A-L "Blue Sheet" on Grade B-47 Hot Work Steel. Allegheny Ludlum Steel Corp. is distributing a four-page folder giving certified technical data on B-47 for hot work applications in general. B-47 is an improved chromium, tungsten, cobalt, vanadium type steel.
Inform-A-Gram No. B36.

Hand and Power Hack Saw Blades, metal and wood cutting band saws, band knives and other products in the Capewell line are extensively described in a new catalog and price book from The Capewell Mfg. Co. A feature is the recently acquired line of Armstrong-Bridgeport pipe tools. The entire catalog is prepared in loose leaf form. THE CAPEWELL MFG. CO., 60 Governor St., Hartford, Conn.
Inform-A-Gram No. B37.

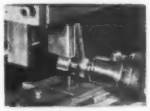
Heller Swiss Pattern Files are now offered as a part of The DoALL Company's line. A new eight-page brochure issued by DoALL features diemaker files, machine files, the needle file and riffler files. The various types are illustrated and fully described, and information concerning size and price is also given. Write for Catalog No. 51-821 to THE DoALL CO., Dept. T&P, 254 N. Laurel Ave., Des Plaines, Ill.
Inform-A-Gram No. B38.

PAYS FOR ITSELF ON "HARD-TO-GET-AT" JOBS

DREMEL
Electric
MOTO-TOOL

"THE POCKET-SIZE MACHINE SHOP"

GRINDING DIES



SHARPENING CUTTERS

BURRING PARTS

MOST POWERFUL TOOL IN ITS CLASS — APPROX. 27,000 R.P.M.

Dremel Moto-Tools, widely used in industry for over 15 years, are World War II veterans—served in defense plants and military maintenance bases everywhere. Hundreds of operations—polishing and grinding dies, burring parts, sharpening cutters, etc.—performed in seconds **without tearing down "set-ups."** Moto-Tool is sturdily constructed for continuous duty. Weighs only 13 oz.—approx. 27,000 r.p.m.—dynamically balanced for vibrationless operation.

MOTO-TOOL KIT NO. 2, with 23 accessories (high-speed steel cutters), and Model 2 Moto-Tool in natural finish hardwood case..... **$23.50**

MOTO-TOOL NO. 2, with one emery wheel point **$16.50**

WRITE FOR INDUSTRIAL CATALOG

DREMEL MFG. CO. Dept. 522-A, RACINE, WIS.

SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

Armstrong Drop Forged Lathe Dogs have hubs large enough to permit re-tapping. These lathe dogs come in ten types with square head or safety headless screws, with straight or bent tails. Full details are obtainable from Armstrong Bros. Tool Co.
Inform-A-Gram No. B39.

Oliver Die Making Machines are extremely fast and accurate on all sawing, filing and lapping operations. Oliver Instrument Co. will furnish technical data on five models.
Inform-A-Gram No. B40.

"Superior" All-Steel Die Sets feature the exclusive Lock-Jaw Lifting Device and E-Z Lift Sling Chain that make it possible to move these die sets for any distance, in any direction. Details are given in Catalog No. 111 of Superior Steel Products Corporation.
Inform-A-Gram No. B41.

Drill Jig Bushing Data, intended to make drill jig designing easier, are condensed into the Colonial Bushings' "Flip-a-page" catalog, available to all T&P readers.
Inform-A-Gram No. B42.

Severance CARBO-MILLS GROUND-from-the-Solid

The all-purpose CARBIDE mill at LOW cost. Use them same as you would High Speed mills or Rotary Files—Same machines—Same speeds (or higher). No more, time consuming, "kid-glove" care. Just chuck them up in your regular equipment and watch these RUGGED CARBO-MILLS go to work!

SOLID CARBIDE CUTTING HEADS

CARBO-MILLS ASK NO SPECIAL FAVORS

3/32" SHANKS
7 Standard Numbers, featuring REAL cutting teeth to remove stock faster over long periods of use—as well after regrinding as when new.

IN PORTABLE TOOLS

CARBO-MILLS by the ORIGINATOR of Ground-from-the-Solid Mills

1/8" SHANKS
12 STANDARD NUMBERS
THE POPULAR WORK BENCH SET

NO PROBLEM OF TOOTH CHIPPING OR BRAZE-FAILURE

CARBO-MILLS PREFERRED BY OPERATORS!

1/4" SHANKS

20 STANDARD NUMBERS

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20 Standard Numbers (only 9 illustrated) cover the widest possible range of uses. Don't continue losing valuable time and money; replace your less efficient Rotary Files with these longer lasting, faster cutting, stamina possessing, CARBO-MILLS at the earliest possible moment!

LAST UP TO 75 TIMES LONGER THAN ROTARY FILES OF HIGH SPEED

REGRINDING — Due to CARBO-MILLS being made of Solid Carbide repeated savings are made possible through successive regrinds.

DIE MAKERS! ASK FOR THIS SET

Furnished to you in a sturdy wooden case; Di-car Set No. 40 is a set of 8, ¼" shank CARBIDE mills designed and instituted specifically for you, the Tool and Die Maker. Specially selected shapes — Special tooth patterns and cuts for all types of precision Tool and Die work. You will ply your skills easier and faster than ever before with these personal finishing mills. These CARBIDE mills need absolutely no coddling and will win their way to the the most favored spot on your Work Bench! Send for complete information and prices today! Ask for Leaflet No. 645

· · · GROUND-from-the-Solid · · ·

INVESTIGATE NOW!
FOR COMPLETE INFORMATION AND PRICES SEND FOR BULLETIN C-M

SEVERANCE TOOL INDUSTRIES, INC.
730 IOWA AVE. ● SAGINAW, MICHIGAN

The New Delta Air Powered Hydraulic Drill Unit is presented in a detailed catalog from the manufacturer. Ordering data and full specifications of models up to ½" drill capacity are included. This drill unit is applicable to a wide range of production situations; and particularly to development of special machines to save time and money on repetitive machining operations. DELTA POWER TOOL DIV., Rockwell Mfg. Co., 613 E. Vienna Ave., Milwaukee 1, Wis.
Inform-A-Gram No. B43.

New Boring Mill Catalog. The Portage Machine Co. has issued a 12-page catalog on horizontal boring, drilling and milling machines, with large dials for easy reading to .001". It illustrates and explains mechanical characteristics, construction and operating details. THE PORTAGE MACHINE CO., 1046 Switzer Ave., Akron, Ohio.
Inform-A-Gram No. B44.

COOL-O-LUBE is a new lubricant-coolant development for metal cutting and drilling operations. Its function is that of lubricating and dissipating heat in all metal cutting operations. Complete information is procurable from AIR CONVERSION RESEARCH CORP., 4107 N. Damen Ave., Chicago 18, Ill.
Inform-A-Gram No. B45.

Built-in Precision is featured by South Bend 16" Swing Precision Lathes, described in new Bulletin No. 5128. Large illustrations of these toolroom lathes are included, along with brief specifications, a partial list of features and a list of distributors. SOUTH BEND LATHE WORKS, Dept. T&P, South Bend 22, Ind.
Inform-A-Gram No. B46.

A New Four-Page Bulletin on electronic contour follower systems for machining irregularly shaped parts is available from G-E. Bulletin GEA-5660 covers one-, two- and three-dimension tracer control systems for use on lathes, boring mills, milling machines, drilling machines, etc. Employing many photos and diagrams, it gives a brief description of each of the systems, its components, features and operation. GENERAL ELECTRIC CO., Dept. T&P, Schenectady 5, N. Y.
Inform-A-Gram No. B47.

Sensitive Precision Drilling Machines. Taylor Dynamometer & Machine Co. announces new Bulletin No. 181 covering their "HI-EFF" line of drilling machines. The publication contains complete specifications and pictures, details all modifications recently made to the equipment. Address TAYLOR DYNAMOMETER & MACHINE CO., 528 W. Highland Ave., Milwaukee 3, Wis.
Inform-A-Gram No. B48.

"Twenty-Five Years of Proof in Service" is a new four-page booklet issued by Meehanite Metal Corp. This publication commemorates the 25th Anniversary of the firm and provides a number of case histories of unusual applications of Meehanite castings in various industries. MEEHANITE METAL CORP., Pershing Square Bldg., New Rochelle, N. Y.
Inform-A-Gram No. B49.

Flexolap is instantly and accurately adjustable for fast cutting and polishing without danger of galling or seizing. Complete particulars are contained in a Federal Tool Corp. brochure.
Inform-A-Gram No. B50.

The Sidney Fluid Tracer, a precision duplicating attachment, is the subject of a highly illustrated, eight-page bulletin. Features, specifications and case histories are included in this attractive publication. Write for a copy to THE SIDNEY MACHINE TOOL CO., Dept. T&P, Sidney, Ohio.
Inform-A-Gram No. B51.

Detroit Die Set Corporation's latest catalog contains 48 pages of dimensions, pictures, prices and other useful information.
Inform-A-Gram No. B52.

Haskins HS-4 Flexible Shaft Equipment is designed to speed pattern, die and mold finishing and to assure quality production. New literature describes Haskins' complete line of machines and attachments for all grinding, sanding, filing and polishing operations.
Inform-A-Gram No. B53.

Grinders and Buffers of many types are shown in 34-page Catalog No. 71 published by The Hisey-Wolf Machine Company of Cincinnati.
Inform-A-Gram No. B54.

No Extra Accessories Needed
Make your own special gages
with standard Heavy Duty BLOCK SETS
You don't have to buy extra accessories when you have Webber's H D Gage Blocks. They are included with each set. Start production rolling immediately. No need to wait for special gages. The blocks can be combined into plug, ring or snap gages with accuracy in millionths. Also used as scriber, height gage and dividers. Inspects dimensions as large as 100". Write for Catalog.
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12903 Triskett Road • Cleveland 11, Ohio
Webber
MICRO-ACCURATE GAGE BLOCKS & FIXTURES
LARGEST EXCLUSIVE MANUFACTURERS OF GAGE BLOCKS

SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

An Improved Line of 4 to 15 Ton Horizontal Broaching Machines is described in Colonial Broach Company's Bulletin No. HS-51. Tables reveal the working capacities and operating specifications of the machines and a plan drawing shows all required installation dimensions. COLONIAL BROACH CO., P. O. Box 37, Harper Station, Detroit 13, Mich.
Inform-A-Gram No. B55.

P&W Vertical Millers and Profilers are covered in 12-page Circular No. 542. This publication contains photos of the machines and typical work produced on them, construction details, specifications and other data. PRATT & WHITNEY, Div. Niles-Bement-Pond Co., 15 Charter Oak Blvd., W. Hartford 1, Conn.
Inform-A-Gram No. B56.

Cost-Cutting Rotary Files, countersinks, high speed cutters and tube deburring files are made by Beaver Rotary File Co. of Los Angeles. Descriptive literature is offered.
Inform-A-Gram No. B57.

TRIPLE PURPOSE MACHINE
FILES...SAWS...STONES
ILLINOIS DIE FILING MACHINE
An accurate, smoothly-operating machine that files, saws and stones the most intricate die shapes... eliminates tedious hand operations...reduces costs. It is quality-built for long, trouble-free service ... hardened and ground shafts running in bronze bushings minimize wear. The holding chuck and clamping device provide perfect file alignment.
Sawing
Write for descriptive literature
Stoning
ILLINOIS
TOOL WORKS
2501 N. Keeler Ave. • Chicago 39, Ill.
MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

Cushion Clutch Air Screw Drivers are announced in Form 5056 from Ingersoll-Rand Co. The cushion clutch construction offers several distinct advantages. It consists of two units—an engaging clutch and a torque limiting clutch. The engaging clutch enables the screw driver to be moved from screw to screw without stopping the motor, since slight forward pressure on the tool is necessary to rotate the bit. The ball-type torque limiting clutch permits adjustment for precise torque control and enables the operator to drive all screws to the same degree of tightness. INGERSOLL-RAND CO., Dept. PT, 11 Broadway, New York 4, N. Y.
Inform-A-Gram No. B58.

Four New Carbide Cutter Sets are described in the current M. A. Ford Mfg. publication, Ford Filings No. 7. Photographs show each tool to familiarize the reader with the specific tool shape and size and to identify the tool by number for reordering convenience. To get your name on the mailing list for this and other issues of Ford Filings, write to M. A. FORD MFG., INC., Dept. V-7, 732 W. River, Davenport, Iowa.
Inform-A-Gram No. B59.

The Crozier Tool Post Turret is featured in a new brochure. This improved turret now has 12-position indexing. It may be aligned with the work with the compound rest of the lathe set at any 30° angle. Other exclusive features are detailed in this publication, and a price list and ordering instructions are also included. CROZIER MACHINE TOOL CO., Dept. T&P, Hawthorne, Calif.
Inform-A-Gram No. B60.

A New Bulletin on Induction Heating has been published by G-E. This 12-page booklet (GEA-5679) describes forging, hardening, brazing and annealing applications at 1000, 3000 and 10,000 cycles. It explains the components and requirements of induction heating with motor-generator type equipment and also covers such applications as forge welding, heating drill bits, continuous heating of moving strip, and surface hardening. GENERAL ELECTRIC CO., Dept. T&P, Schenectady 5, N. Y.
Inform-A-Gram No. B61.

Precision Thread and Form Grinders are presented in a current, fully illustrated catalog of The Sheffield Corp. These machines are designed specifically for Crushtrue grinding as well as for diamond-dressed multi-ribbed wheel grinding and for the conventional single point wheel grinding. THE SHEFFIELD CORP., Dept. T&P, Dayton 1, Ohio.
Inform-A-Gram No. B62.

The Odee-HONE is a single tool for the accurate honing of all parts from ½" to 2½" dia. Complete information can be secured from the manufacturer, Micromatic Hone Corporation.
Inform-A-Gram No. B63.

Barth Special Machines, Tools and Dies are featured in a current catalog. The Cleveland firm, now operating in a new, modern plant, is prepared to handle your most difficult "special" job.
Inform-A-Gram No. B64.

Small, Precision Spur Gear Hobbing is discussed in Hamilton Tool Company's Bulletin No.-00-49. The efficient Hamilton No. 00 Precision Spur Gear Hobber is featured.
Inform-A-Gram No. B65.

The New Line of Sperry Hydraulic Remote Controls is described generally in Bulletin 20-106 just released. These controls are a single tube, balanced, self-contained system operating independently without outside sources of power. They have a maximum rated capacity of 400 in lbs. on the pressure stroke and 125 in. lbs. on the return stroke. For a copy of the bulletin, write to C. E. Hohl, Sales Engineer, SPERRY PRODUCTS, INC., Dept. T&P, Danbury, Conn.
Inform-A-Gram No. B66.

Micro Miniature End Mills can perform such operations as milling, engraving, routing and profiling. A detailed catalog on these precision-ground-from-solid tools is procurable from Woodson Tool Company.
Inform-A-Gram No. B67.

The Bell & Howell Pocket Comparator, a precision optical measuring instrument for fast, accurate inspection of small dimensions, is described in a folder from the distributor, National Tool Company.
Inform-A-Gram No. B68.

Drill Hardened Steels without Annealing –

With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon–high chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are cutting costs in thousands of plants.

You Harden It—We'll Drill It—
With "HARDSTEEL"

BLACK DRILL COMPANY
Division Black Industries
1368 East 222nd St. • Cleveland 17, Ohio

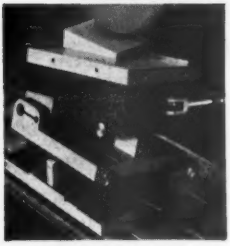
Also makers of—
BLACK DRILLING UNITS—AUTOMATIC, SELF-CONTAINED—FOR COST-CUTTING PRODUCTION ON ALL MATERIALS
Write for information

SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

AGD Adjustable Limit Snap Gages are described and illustrated in new Circular No. 460-3 from Pratt & Whitney. These gages permit rapid, positive checks of maximum and minimum production dimensions on diameter, length or thickness. The circular contains sizes, prices, advantages and a recommended parts list, in addition to many drawings and photographs. Address all requests to PRATT & WHITNEY, Div. Niles-Bement-Pond Co., 15 Charter Oak Blvd., W. Hartford 1, Conn.
Inform-A-Gram No. B69.

Braze-Clad Metals are clad metal combinations of various base metals, ferrous and non-ferrous, clad with a wide range of silver brazing alloys. They have been developed to assure better silver brazed joints and simplified silver brazed assemblies. New Bulletin BC-51, issued by American Silver Co., Inc., tells what Braze-Clad metals are, how they work and where they are useful. AMERICAN SILVER CO., INC., 36-07 Prince St., Flushing 54, N. Y. will honor requests.
Inform-A-Gram No. B70.

ANGULAR SET-UPS
to gauge-block accuracy
IN A FEW MOMENTS



the Magna-Sine

Any angular set-up, single or compound, takes only the time to look up the angle in the Robbins Table of Constants and to insert the indicated gauge blocks between the Magna-Sine plates. It's fast—it's positive, to gauge-block accuracy. Work is held by magnetic attraction. In two models and two sizes; also in non-magnetic models for inspection work.

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Manufacturers of the MAGNA-SINE and Other Precision Tools
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Rapistan Material Flow Conveyors. A 28-page catlog, just released by Rapids-Standard, has hundreds of photos, sketches and charts that show what each item of Rapistan equipment is, how it works and what type of material it handles. The first section gives details on steel and aluminum Rapid-Wheel and Rapid-Roller gravity conveyors. The second half of the catalog includes photos and descriptions of hand and stock trucks, industrial casters and floor locks. THE RAPIDS-STANDARD CO., INC., Dept. GC-52, 342 Rapistan Bldg., Grand Rapids 2, Mich.
Inform-A-Gram No. B71.

Accurate, Smooth Drilling, countersinking, counterboring and reaming can be done in steels hardened by any process without first annealing the work, by use of the improved "Hardsteel" Drill. Black Drill Co. has compiled the helpful "Hardsteel" Operator's Manual.
Inform-A-Gram No. B72.

UNBRAKO "Standards" is a new booklet from Standard Pressed Steel Co., telling what these "standards" are and the advantages of using such standard screw products.
Inform-A-Gram No. B73.

The Froom Load Centering Eye Bolt permits the safe lifting of heavy dies, tools, machinery, etc. Descriptive literature has been issued by the manufacturer.
Inform-A-Gram No. B74.

Secomet Diamond Wheels cut faster, run cooler and give longer life, according to literature released by the manufacturer, J. K. Smit & Sons.
Inform-A-Gram No. B75.

Carbide Tipped Milling Cutters are presented in a new two-color brochure from The DoALL Co. Catalog No. 51-824 covers carbide side mills, face mills, end mills and drills (for hard steel). There are 12 pages with excellent illustrations, technical information concerning recommended cutter speed and chip load, machine setup, operation of cutters, and price data. THE DoALL CO., 254 N. Laurel, Des Plaines, Ill.
Inform-A-Gram No. B76.

The "Multiform" Bender-Cutter is presented in a J. A. Richards brochure. Sketches illustrate some of the possible arrangements for forming operations with hand and air operated models.
Inform-A-Gram No. B77.

Inclinable, Straight Side and Horning Presses are pictured in recent Thomas Machine Manufacturing Co. literature. Design features that make every Thomas Press rugged and safe are detailed.
Inform-A-Gram No. B78.

Lassy's Efficient Universal Tap and Die Guide Fixture is available from stock in three sizes. Twelve tap adapters are provided with this tool, according to a folder from Lassy Tool Company.
Inform-A-Gram No. B79.

Precision Carbide Dies of many types are made by Harig Mfg. Corp. The firm's latest literature points out advantages of longer die life, less downtime, greater production and lower cost per piece.
Inform-A-Gram No. B80.

Chicago Internal Grinding Wheels are manufactured to order and can be delivered speedily. Full information and a free sample wheel can be had from Chicago Wheel & Mfg. Co.
Inform-A-Gram No. B81.

Lavallee & Ide, Inc., offers a 32-page catalog on its line of ground flute reamers. Illustrations, prices and complete dimensions and other data are given. Write for a copy of Catalog No. 51 to LAVALLEE & IDE, INC., Dept. T&P, Chicopee, Mass.
Inform-A-Gram No. B82.

The Yost Drill Press Vise, designed expressly for use on drill press operations, is made in two sizes. A current bulletin features this vise and also covers the rest of the Yost line.
Inform-A-Gram No. B83.

New du Mont Catalog X pictures and gives specifications on the "Minute Man" line of 23 standard sizes of keyway broaches and 21 standard keyway broach sets. Other du Mont products are described. THE du MONT CORP., Dept. T&P, Greenfield, Mass.
Inform-A-Gram No. B84.

"Five Steps to Faster Small-Hole Drilling" are outlined in the Electro-Mechano Co. publication of this name. Specifications and dimensions are given for the company's automatic drilling units.
Inform-A-Gram No. B85.

Your Entire Stock of Drills...
Seen at a glance
HUOT DRILL DISPENSER
for
• TOOL CRIBS • STOCK ROOMS • MACHINE SHOPS
Saves Time hunting through stacks of packaged drills. Compartments hold a gross of small sizes—a dozen or more of the larger ones. Raised letters on easy sliding drawers . . . hammerlin gray baked enamel finish . . . 14⅓"x7¼"x7¼".
Write for Circular
Model No. 1: Fractional drills ¼" to ½"
Model No. 2: Number drills 1 to 60
Model No. 3: Letter drills A to Z
HUOT MFG. CO.
581 NORTH WHEELER ST. PAUL 5, MINNESOTA

. . . Stainless Steels, from page 132

TABLE VI. HARDNESS VALUES vs. QUENCHING TEMPERATURES.

A. I. S. I. Type	Quenching Temperature, deg. F.	Brinell Hardness	Rockwell 'C' Hardness
410, 403, 416	1700 to 1850	380 to 415	39 to 43
414	1800 to 1950	400 to 450	42 to 47
431	1800 to 1950	400 to 440	42 to 46
420, 420F	1800 to 1900	530 to 560	53 to 56
440A	1850 to 1950	555 to 590	55 to 58
440B	1850 to 1950	575 to 610	57 to 59
440C, 440F	1850 to 1950	620 to 630	60 to 62

maximum toughness is required; and the high side of the range is employed when maximum elastic properties are desired.[3]

The use of the tempering range of 750° to 950° F. should be avoided since the hardenable stainless steels develop lower impact strength when tempered in this range. Tempering is therefore generally confined to the range of 1000° to 1400° F.; values derived from tempering within this range are given in Table IV. Increase in tempering temperature indicates a decrease in strength and hardness accompanied by an increase in ductility and toughness. The cooling rate from the tempering temperature has no marked effect on the tensile strength properties or hardness and either air, oil or water will serve equally well.

Of interest is the relationship between tempering temperature and corrosion resistance of a 410 type stainless steel as indicated in Figure 5. All of the samples were hardened by oil quenching from 1800° F. and then re-heated for four hours at the drawing temperature indicated. The curve is based on a 50-hour immersion test utilizing a 10 percent boiling acetic acid to emphasize the effect of the drawing temperature.

Surface Hardening

Of interest is the various surface hardening methods used to increase wear resistance and decrease the tendency to seize and gall. However, some reduction in corrosion resistance is experienced; in many instances, however, adequate resistance is maintained. Thus in the nitriding of the various stainless steels, case depths from 0.005 to 0.020 inches can be obtained; the surface hardness varying from C65 to C73 Rockwell (converted from Rockwell 15N Superficial). Typical case hardness versus depth surveys for four different types of stainless steels are illustrated in Figure 6; these values being determined by Low[4].

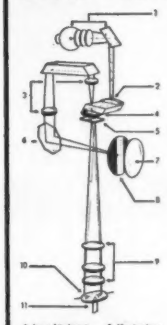
In the malcomizing process[4] as developed by Chapman Valve, the conventional prior heat treatment as practiced with the standard nitriding steels is required on the standard A.I.S.I. 400 series within the hardenable grades. Both the ferritic and the austenitic stainless steels are usually annealed prior to nitriding. The depth of case as previously indicated is dependent upon the composition; a standard 40-hour cycle will produce from 0.007 to 0.009 inches

(Continued on page 158)

TABLE VII. PHYSICAL PROPERTY RANGE OF ARMCO 17-4 PH[2].

Chemical Composition, 17-4 PH			Annealed 1800/1900° F. ½ hr. Air C.	deg. Fahr., one Hardened, 900 hour Air Cooled
Carbon	0.05%	Ultimate Tensile Strength, psi	135,000/165,000	190,000/210,000
Chromium	16.50%	Yield Strength, 0.2%, psi	95,000/125,000	170,000/200,000
Nickel	4.00%	Proportional Limit, psi	——	115,000/140,000
Copper	4.00%	Elongation, % in 2 in.	6 to 15	6 to 15
		Hardness, Rockwell C	30 to 35	40 to 45
		Brinell Hardness	300 to 400	375 to 440
		Izod Impact, ft. lbs.	——	10 to 20
		Modulus of Elasticity, psi	——	28,500,000

NEW OPTICAL METHOD GUARANTEES PRECISION



USE THE LEITZ PROJECTION ORTHOMETER

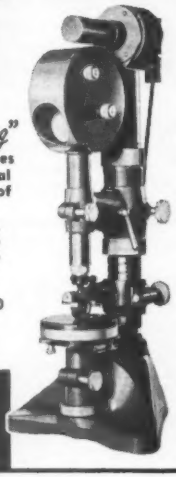
"It's Optical Measuring"

The absence of mechanical or electronic parts assures superior accuracy and reliability since the optical method is practically unaffected by heat, wear of parts, backlash, etc...

This LEITZ ORTHOMETER speeds up inspection, allows more than one person to view scale simultaneously. The only moving parts are the contact tip and mirror.

One graduation represents 50 millionths. Guaranteed accuracy over full range of 200 graduations (.010") is .00001".

BE SAFE — SEND FOR GUIDE "OPTICAL MEASURING METHODS".



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200-T LAFAYETTE ST. • N.Y. 12, N.Y.

"...it's the bushing that makes the wHOLE difference"

To maintain maximum accuracy in drilling operations, use the bushing that's precision made for the job . . . use Acme! Write for catalog.

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Interchangeable
Concentric

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Makers of Hardened and Ground Precision Parts

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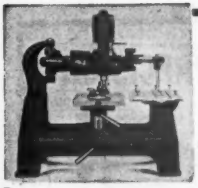
THE SERVICE SHOP TO INDUSTRY FOR MORE THAN 25 YEARS

SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS



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ON
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OTHER METALS
PLASTICS

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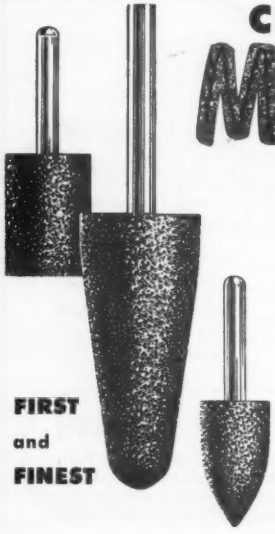

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Association of Bearing Specialists

A new trade organization of national scope, to be known as the Association of Bearing Specialists, has been incorporated under the laws of the State of Illinois according to William F. Chase, Bearing Service Co., Pittsburgh, who has been named Chairman of the Board.

With a membership of concerns whose primary purpose is supplying ball and roller bearings to industry for maintenance, the Association's first meeting was held last month in Houston, Texas.

In addition to Mr. Chase, the following officers and directors were elected: J. R. Gelomb, Iowa Bearing Co., Davenport, Ia., President; Gene Tappero, Michigan Bearing Co., Detroit, Vice President; W. S. McClendon, Behrings Bearing Service, Inc., Houston, Secretary; and Harold E. Johnson, General Bearings Co., Chicago, Treasurer.

Board members: Mr. Chase, Chairman; G. W. Elftman, General Bearings Co., Los Angeles; J. Hudson Crockett, Standard Machine & Supply Co., Norfolk, Va.; Frank J. Stevens, Bearing Distributors, Inc., Kansas City, Mo.; J. K. Weiser, Minnesota Bearings Co., Minneapolis; and Mr. McClendon.

Labor Relations Conference Feb. 12

Plans for a national conference on labor relations issues have been announced by the Chamber of Commerce of the United States, with the Pittsburgh, Pa. Chamber serving host and co-sponsor on Feb. 12.

Four main problems will be discussed, with participation by labor authorities from both business and government circles. The subjects are:

Wage and Salary Stabilization.

The Collective Bargaining Outlook During the Defense Economy.

Labor and Politics in 1952.

Manpower Problems and Developments.

In its discussion of wage and salary stabilization, the conference will attempt to get a preview of possible 1952 trends. Speakers will include two Wage Stabilization Board members, Hiram S. Hall and Richard P. Doherty and Labor Statistics Commissioner Ewan Clague. Salary stabilization will be discussed by V. Henry Rothschild, Salary Stabilization Board member and counsel.

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New Canco Research Setup Aimed at Tin Elimination

A major organizational change to enable the American Can Company to place more emphasis on creative research through establishment of a new Research and Technical Service Department has been announced by Dr. R. H. Lueck, general manager of research.

Designed to create and develop original ideas and techniques that will benefit the nation's consumers, canners and farmers, the newly established Canco department will consist of the Research, Development, Technical Service and Agronomy divisions.

The Research and Development divisions will be concerned with applied research in the fields of packaging and container manufacture, including such outstanding projects as the conservation and eventual elimination of tin, new containers for beverages, and investigation of the cold sterilization of canned foods. The Technical Service and Agronomy divisions will be concerned with technical services to canners, growers and the company's can making facilities.

To carry out this combined program of research and technical service, the company has appointed Dr. B. S. Clark, formerly director of research, as scientific director. Dr. R. W. Pilcher, former associate director of research, has been appointed director of the new research division.

D. F. Sampson, former section chief, General Laboratories, has been named manager of the Technical Service Division, while Dr. F. W. Geise remains manager of the Agronomy Division at Chicago, which is now integrated on a national scale with a resident agronomist in each of the company's four geographical divisions. The Development Division has yet to be activated.

A special laboratory at Maywood, Ill., will be devoted to applied research, exclusively, while the remainder of the staff of the former general laboratory at Maywood will function as a technical service unit for the company's Central Divisional laboratories at Newark, N. J., San Francisco and Hamilton, Ontario.

Outlining the policy of the move, W. C. Stolk, president of the company, said: "The future of the company depends very largely on the success of a strong research

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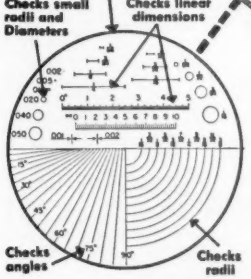

● A precision optical measuring instrument for fast, accurate inspection of small dimensions. Save time and money measuring wear on cutting tools, checking forms and dimensions of punches, dies and gauges—as well as radii, angles, chamfers, threads and small holes on production parts.

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program. We must create new products from new materials and find new uses for existing products. We must devise methods to reduce costs in the face of the present economy."

"Particular emphasis," Dr. Lueck stated, "will be placed on the company's current 'Operation Survival' program with a view toward the freeing of this country in the shortest possible time from dependence upon foreign tin supplies." He also said that another prime project would be that of studying the cold sterilization of canned foods by gamma radiation from radioactive waste material, of which this country has a growing supply. Gamma radiation, said Dr. Lueck, differs from beta radiation, which has been used recently in sterilization tests on a number of foods, in that the gamma rays have a much higher penetrating power and are capable of being applied to the largest cans used commercially.

One of the most important provisions of the new plan has been the establishment of a Research Advisory Panel consisting of top executives of the company. This panel will serve as a "watchdog" over the program and will streamline the company's research activities. It will evaluate the immediate and long range needs of the company, and gear the research program to such requirements.

In the can manufacturing industry, as well as in other industries, he said, there has been a steadily growing need for research programs where a group of men, each trained in a separate field of inquiry, could be thrown into the attack of a problem as a team and be permitted to pursue their effort uninterruptedly over a prolonged period. The development of the atomic bomb in World War II is the classic example of the success of research teams.

Dr. Lueck, in further explaining the organizational change, said the company was merely segregating its creative research functions, and not divorcing them from its technical service functions.

Technical service, he explained, often pinpoints the need for research, while research produces the knowledge that improves the quality and effectiveness of technical service.

"Our new research group is no 'ivory tower,' segregated from the main flow of the company's interests," he said. "Our group will be a pragmatic organization whose objectives are realistic. . . . "

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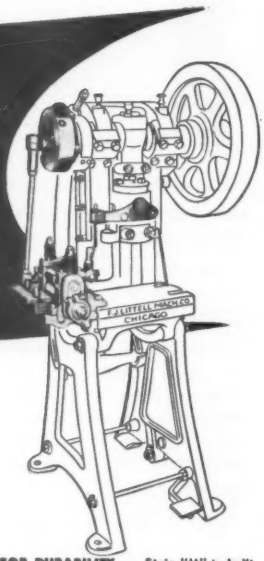

FOR SPEED . . . With Style "M" automatic feeding your press can easily produce 9,000 stampings an hour at 200 strokes per minute, or 4,600 stampings an hour at 100 strokes per minute.

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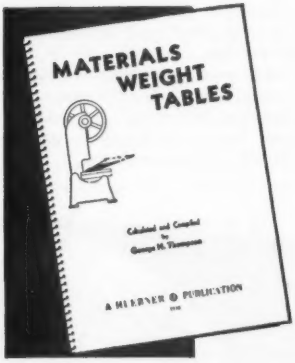

"Faster than a Slide Rule" for calculating the total weight of sheet stock required for a given press run.

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The book includes 32 pages of tables for sheet stock, 4 pages for bar stock, 3 pages for drill rod and conversion factors for 20 different metals, thus making the tables apply to almost any stock you might be working.

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Norton's Frank W. Smith Retires

The retirement of Frank W. Smith, vice president in charge of Norton Company's Grinding Machine Division operations, has been announced by Milton P. Higgins, president.

Mr. Smith will remain with the Worcester, Mass., company as a consultant responsible for the construction of Norton's new $6,000,000 machine division expansion, but will relinquish all responsibility for the operation of the division to Everett M. Hicks, manager. Mr. Hicks will report directly to Ralph F. Gow, executive vice president. Mr. Smith has been with the company 33 years.

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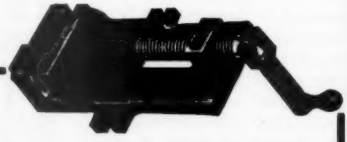

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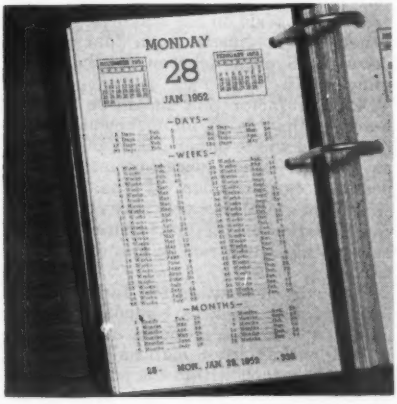
When Is 3 Months from 3 Days Ago?

A glance at the newly designed Schedule-A-Date calendar tells the purchasing, order, sales and production departments the exact date to specify for future delivery, and to translate suppliers' delivery schedules into definite future dates—dates that are necessary for proper follow-up and accurate planning.

This unique desk calendar gives future dates by days, weeks and months, as regularly used in business, for each day and for a complete year in advance.

For purposes of example, suppose today is January 28, 1952, and this occurs: A supplier says he will make shipment in six weeks, another in 14 weeks. What



are the actual delivery dates? Or, one job must be completed in 90 days and another in 12 weeks. What are the dates?

A look at the proper Schedule-A-Date page will quickly provide the answer to these and similar problems. Besides offering this time-saving feature, Schedule-A-Date eliminates the possibility of error in counting on a regular calendar.

Schedule-A-Date pads are sold for $1.75 each by the Schedule-A-Date Calendar Co. 310 E. State St., Ithaca 4, New York. A cold rolled steel base, with nickel and rubber feet, is priced at $1.60.

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. . . Stainless Steels, from page 150

of case[9] on either type 303 or 304 and from 0.015 to 0.018 inches on the straight chromium types such as 410 and 416. Experience has proved that this cycle is the most economical and useful, as longer time cycles do not yield proportional increases in case depth.

Some dimensional changes should be expected; the exact amount can be predetermined by an experimental run. Usually an increase from 0.001 to 0.002 inches on the diameter or thickness can be expected; this value varying with the depth of case. Growth also will occur on inside diameters or dimensions; this being determined only through experimentation since this change will vary with the dimension size and shape.

Induction heating is also used for the surface hardening of some of the martensitic stainless steels resulting in a very hard surface with a soft and tougher core. The application of current is very brief, usually a one-second time period for a two inch diameter bar heats the surface alone. Automatic water quenching is not recommended, however both air and oil quenching can be employed. The advantage of this type of process is that surface hardening can be restricted to selected areas and the depth of hardening may be regulated by adjusting the frequency.

Furnace Equipment

The choice of furnace equipment in the heat treatment of the stainless steels is quite varied, and is governed by such factors as production requirements per manhour, available equipment within the plant, quality requirements, and the subsequent finishing operations required to produce the desired finish in the completed part.

A satisfactory furnace should not only heat the articles thoroughly and uniformly at the specified temperature, but also produce an item which has a minimum of scale; or at least scale in a form which is easily removed. Experience has proved that scale control in a heat treating operation is a decided economy since removal of scale on the stainless steels is usually more difficult than that experienced with either carbon or the lower alloy steels.

Another factor that should be remembered is that flame impingement should be avoided where either gas or oil is used as a fuel since decarburization and possibly carburization of the straight chromium stainless steels may occur. Decarburization on the martensitic hardenable stainless will realize loss of surface hardness.

Carburization within the furnace may result if the stainless compositions are either exposed to a reducing atmosphere, or are packed in a material that will introduce carbon within the surface such as charcoal, coke, bone black, etc. resulting in a serious loss of corrosion resistance.

As previously mentioned, soaking at the high temperatures normally employed for an extended length of time may result in undesirable grain growth; this being particularly true in the annealing of the austenitic stainless. Thus, in a interprocess anneal of a drawn shell made from type 302, prolonged soaking will cause grain growth which will manifest itself in the form of an "orange peel" upon subsequent draws.

Finishing costs may increase tremendously in the removal of this coarse

(Continued on page 164)

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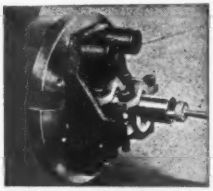

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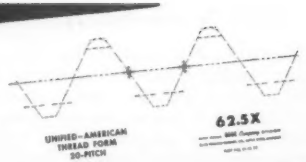

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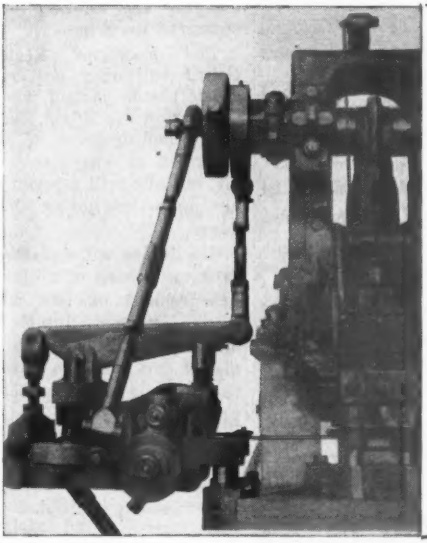

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DPA Moves to Utilize Idle Plant Capacity for Defense

A program for screening idle plant production capacity in the United States with a view toward utilizing these facilities for essential defense work, has been announced by the Procurement and Production Division of the Defense Production Administration.

Because large amounts of controlled materials—steel, copper and aluminum—are needed in the defense effort, many plants engaged in civilian production now face the prospect of shutting down part of their facilities unless they can get defense contracts.

It has always been DPA's policy to utilize idle plant capacity as far as possible before authorizing the construction of new facilities. A newly-created Facilities Review Board is designed to make this policy more effective.

The Board will undertake the task of screening all idle production facilities with a value of $1,000,000 or more (including the cost of machine tools) and will bring these facilities to the attention of military procurement officials.

Whenever necessary, the Board will call upon various NPA industry divisions for advice and help, and also will cooperate closely with procurement branches of the Armed Forces.

It has been necessary, initially, to set a lower limit of $1,000,000 on the size of facility that will be considered by the Board, to insure the maximum utilization of facilities that can be most readily used in defense production, and to reduce the committee's work load to a point where it can operate efficiently without delaying the military procurement program.

The Facilities Review Board will offer not only aid to plants part of whose production facilities have been idled because of the diversion of scarce materials, but also will attempt to anticipate impending shutdowns.

The Board will call these to the attention of military procurement officials with a view toward lining up military contracts so these plants can continue operations at or near capacity production.

Firms desiring to make use of the Facilities Review Board should do so through their industry division in the National Production Authority.

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Record Number of Exhibits Features 1952 Tool Show

With 2½ months remaining before the opening of the 1952 A.S.T.E. Industrial Exposition, reports from Society headquarters show that the number of exhibitors in this year's show, which will be held in the International Amphitheatre, Chicago, from March 17-21, already exceeds the former record-breaking number at the 1950 Exposition in Philadelphia.

Assignment of space is under way and plans are completed for simultaneous technical sessions and panel discussions to be held on each of the feature days: Inspection and Quality Control Day, Metal Cutting Day, Materials Forming Day, Grinding and Finishing Day, and Machine Accessories, Drives and Controls Day.

Preparations have been made for the distribution of more than 400,000 invitations to attend the Exposition.

One of the unique features of the 1952 Exposition is the allocation of a huge area—the South Hall, Second Floor at the International Amphitheatre—to exhibits of quality control equipment. Quality Control Hall, as it will be called, will include exhibits of instruments, inspection equipment, gaging equipment, measuring equipment, charts and related quality control equipment. Several leading U. S. industrial corporations also have taken space in this hall to show how they apply quality control equipment in their manufacturing processes.

Since the technical sessions deal with the specific fields of interest of each of the feature days, a new method of relating equipment at the Exposition to those attending the technical sessions will be used.

At each of the technical sessions, a list of exhibitors (and their booth numbers) whose equipment relates to the general subject of the feature day will be distributed. Thus, those who indicate their special interest by attending the sessions on certain days will have a handy reference of equipment at the show applicable to their special field.

To insure panel discussion coverage of major subjects of vital importance to both civilian and defense industries, the entire A.S.T.E. membership is being asked in advance to submit questions to the panels on special return blanks.

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HYDRAULIC PUMP or MOTOR GEROTER TYPE
Logan Gerotor type. For operating hydraulic systems on trucks, tractors, etc. Delivers 8 GPM at 1200 RPM at 1000 PSI with 5 HP. Can also be used as Hydraulic fluid motor. 3/8" stand pipe ports. ½" splined shaft for pulley or direct attachment. 5½" dia., 7" long. Used but condition guaranteed.
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Gives 20,000 lb. thrust (push or pull) using 1500 PSI line pressure as obtained from our hydraulic pumps. Will produce up to 40,000 lb. thrust with 3000 PSI. Can also be used on low pressure air systems. 4" bore; 18" stroke; 30½" length. Ideal for road-farm-shop machinery.
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With built-in variable flow control valve in head. Positive displacement piston type. Displacement capacity: 2 gal. per min. at 1500 RPM or 1250 PSI. Pressure limit 1250 PSI continuous. 1400 PSI for 15 sec. Operates at 3750 RPM, intermittent max. 4500 RPM. Rotates either direction without adjustment . .
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No. 3 HYDRAULIC CYLINDER
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Positive displacement type, angle piston. Displaces .507 cu. in. per revolution. Has capacity of 6 gal. per min. at 3000 RPM or 1500 PSI, continuous, 1875 for 15 sec. Operating speed of 3750 RPM, intermittent maximum, 4500 RPM. Rotates to the right only.
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FILTERS
Complete engineering data on synclinal type filters for sump or line installation on hydraulic equipment are contained in new Marvel Folder No. 105.
Circle No. E1.

VALVES
An attractively printed 28-page catalog section, No. 203, covers the extensive line of Rivett Hydraulic Valves, available in five different piston designs.
Circle No. E2.

TOOL SPECIALTIES
Vlier's latest catalog has pictures, dimensions and applications of springs plungers, fixture keys, spring stops, toggle pads and torque thumb screws.
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OBI PRESSES
Precision built for precision work are Sales Service Press-Rite Power Presses, described in a new folder of specifications and descriptive text.
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MASTER MAKER
A four-pager gives full details on the Fryer Master Maker. This triple-purpose tool serves as a master maker, master eliminator and marking device.
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HAND SCREW MACHINE
Brown & Sharpe's new No. 0 Hand Screw machine is described as to features, dimensions and specifications in an illustrated folder.
Circle No. E6.

SPEED VISE
Faster production with Cardinal Type B Speed Vise is highlighted in Bulletin No. 24. Prices, specifications and photographs are included in this bulletin.
Circle No. E7.

ELECTRON DRILL
A new Elox brochure tells how broken taps, drills, reamers and studs can be quickly and economically removed with the M7 Tapmaster Electron Drill.
Circle No. E8.

MILLERS & PROFILERS
Pratt & Whitney Vertical Millers and Profilers are the subject of profusely illustrated Circular 542. Many applications are shown.
Circle No. E9.

GEAR DEBURIZER
The Sheffield machine tool featured in this catalog has the ability to deburize many types of gears, and to remove all types of burrs at a new low cost.
Circle No. E10.

CYLINDERS
"Use a Cylinder and Save a Man" is the theme of current Ledeen Bulletin 152, which calls attention to applications where manual power can be reduced.
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DISC GRINDING
A unique, 32-page Gardner catalog shows modern methods of flat surface disc grinding. Each page fully covers a job on which the machine was used.
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Here, for the first time, is a complete guide to successful silver brazing. Published by The American Platinum Works, it has 46 pocket-size pages.
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BARREL-FINISHING
Another valuable Norton "know-how" booklet has been prepared. It's the 48-page "Barrel-Finish-with Alundum Tumbling Abrasive," designated Form 501.
Circle No. E16.

FILES
Heller Swiss Pattern Files, used chiefly on tool and die work, are described in Do-ALL Catalog 51-821. There are eight pages of photos, prices and sizes.
Circle No. E13.

LATHE ATTACHMENTS
Over 160 different attachments and accessories for South Bend Lathes, Drill Presses and Shapers are pictured in 35-page Catalog 5102.
Circle No. E14.

CONTROLS
What is a Push Pull Control? An interesting, 12-page, illustrated publication of American Chain & Cable Co., Inc., fully answers this question.
Circle No. E17.

TURRET LATHE
Potter & Johnston Bulletin No. 145 contains full data on Model 3U Speed-Flex Automatic Turret Lathe, designed for high speed production of small parts.
Circle No. E18.

PRESS BRAKES
New Airtherm Catalog 907 features complete information and specifications on Series 1500 and 2000 "Metalworker" Press Brakes and steel forming dies.
Circle No. E19.

INDUCTION HEATING
Equipment for induction heating is described in G-E's 12-page, two-color Bulletin GEA-5679. Various applications are shown.
Circle No. E20.

HANDLING
A pictorial presentation of Barrett handling equipment is contained in brand-new Bulletin 5195. Trucks, tractors and portable elevators are included.
Circle No. E21.

LUBRICANTS
Case histories of industrial applications of Molykote Lubricants make up Bulletin 93 of The Alpha Corp. It includes applications to machine tools, dies.
Circle No. E22.

ABRASIVE POINTS
This four-page catalog covers Simonds Demountable Abrasive Points with removable spindles. Standard sizes and shapes are illustrated in this catalog.
Circle No. E23.

WHEEL DRESSER
The Last Word Wheel Dresser has been developed for accurate angle tangent to radius wheel dressing. An illustrated folder details important features.
Circle No. E24.

SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

. . . Stainless Steels, from page 158

surface in the event that a high finish of the part is required. Adequate temperature control is important especially in tempering where the hardened articles must be drawn to narrow ranges of hardness and tensile properties.

The choice of heating medium is relatively unimportant as long as the precautions as listed above are observed. The choice as to whether a batch type furnace or a continuous furnace should be employed will be governed mostly by the production requirements and by the size and shape of the item. In some instances, it is advisable to use a controlled atmosphere which will either prevent or minimize the scale formation and thus reduce pickling costs.

Completely scale-free treatment of the stainless steels will require a gas tight furnace and the use of an atmosphere; thus dissociated ammonia is widely accepted as a suitable atmosphere. Since the cost of generation of this type of atmosphere is quite high, it is usually limited to applications where atmosphere losses are at a minimum. Purified hydrogen is sometimes used but commercial installations are few due to the expenses and time involved in purification.

The salt bath is being used quite widely for the heat treatment of the stainless steels. The life of an externally heated alloy pot is comparatively short, varying from a few weeks to several months, depending upon the temperature of treatment. Where a ceramic pot is used and the salt is heated by an immersed electrode, the life is considerably longer with the added advantage that the salt will not be contaminated by metallic oxides.

As mentioned previously, induction heating can be used to advantage, but it has one disadvantage where selective hardening is done on a section which is to be highly polished. Experiences in the investigation of induction heating in the selective hardening of cutlery revealed that upon high finishing, a definite demarcation line was evident between the edge that was hardened and the back that was unhardened. This may detract from customer appeal. The time cycle is very short and in many instances a semi-automatic setup can be used involving a heat and quench, thus realizing very high production.

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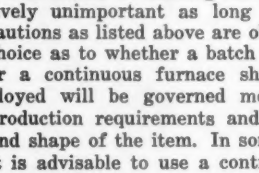

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Scale Removal

Whenever high temperatures are involved, a surface scale results which must necessarily be removed in order to realize full corrosion resistance of the part and to improve its appearance. The variability in both the complexity and the tenacity of this scale formation would be influenced by several factors, among which are the alloy composition, the method of heat treatment involved, both the time and temperature of treatment, and the nature of the furnace atmosphere.

The methods that are available in the removal of a scale formation may be either a mechanical removal such as sand blasting or tumbling, or a chemical method of removal which would entail the use of pickling acids.

Sand blasting procedures can be employed on items such as forgings, castings, and other parts where the mechanical action of the sand or grit would have no harmful effect. If this method of scale removal is employed, it is advisable to follow the precautions as outlined below[5]:

(1) clean, iron-free sand should be employed;

(2) the size of the sand particles and the air pressure should be regulated so as to prevent embedding the scale in the surface of the metal rather than removing it;

(3) if hardened steel grit is used for blasting, it should be followed by thorough cleaning with acid to remove all traces of iron which becomes embedded in the surface of the steel;

(4) generally, sand blasting is followed by pickling to make certain that all of the scale has been removed; and,

(5) sandblasting must be followed by a rinse in a dilute solution of nitric acid to prevent contamination of the surface with iron particles.

The term "pickling" usually denotes the removal of scale by acid solutions. However, in the event of pickling the stainless steels, molten alkalis and alkaline solutions containing additive re-agents work equally as well. Basically, the alkalis affect only the scale and have no effect on the parent metal.

Molten alkalis often contain additive chemicals that alter the composition of the scale, making it more amenable to attack by acids. At the same time, the molten alkalis, used at relatively high temperatures, tend to soften the scale[12], and when the metal is water quenched from the operating temperature, a shattering effect is produced on the scale as a result

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SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

of the action between the water and the hot alkali. A number of methods of scale removal are presented [12]; but to insure against the violation of any patent interest, prospective users should investigate the status of all methods mentioned.

Method 1

1. Immerse in molten sodium hydroxide containing 20 to 40 percent by weight of sodium nitrate at 850° to 950° F., for 15 minutes. Water quench.

2. Immerse in 10 to 12 percent by volume of sulfuric acid containing a good inhibitor at 160° to 180° F., for 3 to 5 minutes. Remove and wash.

3. Immerse in a 7 percent by weight nitric acid solution containing 1 percent by weight of hydrofluoric acid for 6 to 10 minutes. Remove and wash thoroughly with running water, preferably used under pressure. (Solution No. 3 is heated to 160° to 170° F., for the chrome-nickel steels, while operating at room temperature will suffice for the straight chromium steels.)

Method 2*

1. Immerse in molten sodium hydroxide containing 1.5 to 2.5 percent sodium hydride at 750° to 800° F., for 10 to 15 minutes. Water quench.

2. Immerse in 10 to 12 percent by volume of sulfuric acid containing a good inhibitor at 160° to 180° F., for 1 to 2 minutes. Remove and wash.

3. Immerse in a 7 percent by weight nitric acid solution containing 1 percent by weight hydrofluoric acid for 5 to 10 minutes. Remove and wash thoroughly with running water, preferably used under pressure. (This solution is heated to 160° to 170° F., for the chrome-nickel steels while operating at room temperature will suffice for the straight chromium steels.)

Method 3

1. Immerse in a 10 to 12 percent by volume sulfuric acid solution containing a good inhibitor at 160° to 180° F., for 5 to 7 minutes. Remove and wash.

2. Immerse in a 12 to 14 percent by weight sodium hydroxide solution containing 5 to 6 percent by weight potassium permanganate at 170° to 180° F., for 20 to 30 minutes. Remove and wash.

3. Immerse in solution No. 1 for 3 to 5 minutes. Remove and wash.

4. Immerse in 7 percent by weight nitric acid solution containing one percent

*Patent rights granted to E.I. du Pont de Nemours & Co., Inc.

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by weight hydrofluoric acid for 8 to 12 minutes. Remove and wash thoroughly with running water, preferably used under pressure. (Solution No. 4 is heated to 160° to 170° F., for the chrome-nickel steels, while operating at room temperature will suffice for the straight chromium steels.)

Method 4

1. Immerse in a 10 to 12 percent by volume sulfuric acid solution containing 2 to 4 percent by weight sodium chloride, with a good commercial inhibitor added, at 150° to 170° F., for 10 to 15 minutes. Remove and wash.

2. Immerse in a 10 percent by weight nitric acid solution containing 2 percent by weight hydrofluoric acid for 8 to 15 minutes. Remove and wash thoroughly with running water, preferably under pressure. (Solution No. 2 is heated to 140° to 160° F., for the chrome-nickel steels, while operating at room temperature will suffice for the straight chromium steels.)

Method 5

1. Immerse in a 10 to 12 percent by volume sulfuric acid solution containing approximately 5 percent by weight ferric sulfate for 15 to 20 minutes at 160° to 180° F. Remove and wash.

2. Immerse in a 10 percent by weight nitric acid solution containing 2 percent by weight of hydrofluoric acid for 8 to 15 minutes. Remove and wash thoroughly with running water, preferable under pressure. Note:— This method is suitable for chrome-nickel grades only; solution No. 2 is heated to 140° to 160° F.

Method 6

1. Immerse in a 10 to 12 percent by volume sulfuric acid solution containing a good inhibitor for 15 to 20 minutes at 160° to 180° F. Remove and wash.

2. Immerse in a 10 percent by weight nitric acid solution containing 2 percent by weight hydrofluoric acid for 8 to 15 minutes. Remove and wash. (Solution No. 2 is heated to 140° to 160° F., for the chrome-nickel steels, while operating at room temperature will suffice for the straight chromium steels.)

Alkaline solutions of moderate concentrations that contain strong oxidizing agents (Ex.—Method 1, Step 1) are used primarily to change the composition of the scale to a form that is more susceptible to attack in acid solutions. While

(Continued on page 174)

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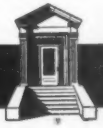

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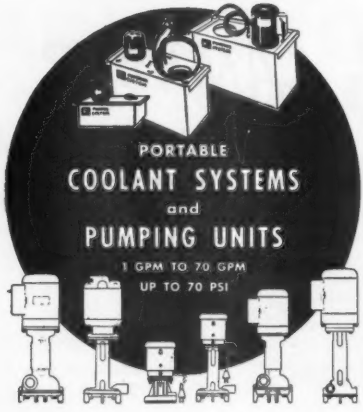

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. . . Hydraulic Piercing, from page 93

hydraulic fluid motor through a speed reducer. A large ring gear is used to drive the index table actuated by a pinion which is driven by the speed reducer.

The machine illustrated has a capacity of 56 tons at 10,000 psi working pressure. The hydraulic power system is completely free of high pressure surge shocks due to the unique design of the hydraulic converter. There are no high pressure controls except the converter itself. All directional controls and pressure relief valves are of standard design, either 1000 psi for 5000 psi operations or 2000 psi for 10,000 psi operations. The high pressure converter is a combination of a continuous booster and low and high pressure admission valve. The selector spool in the high pressure admission valve has a built-in decompression spool which prevents directional spool from shifting until oil under compression has been released, and, therefore, no surge shock ever occurs. All hydraulic directional controls, including converter, are panel mounted and easily accessible.

The electronic controls, including magnetic starter and line voltage to 110 volt transformer, as well as all control releases, are mounted in an enclosed cabinet per J.I.C. electric standards. The push button station is conveniently located for the operator and has all the necessary control buttons to actuate the machine. A selector switch is provided for either automatic or manual operation. The purpose of the manual operating circuit is for setup purposes only.

★ ★ ★

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An intensive three-month iron and steel scrap drive by Westinghouse Electric Corporation has boosted the nation's dwindling stockpile nearly 5000 tons. This is enough for 500 medium tanks, according to Andrew H. Phelps, Vice President of Purchasing and Traffic.

Twenty-two major plants and all manufacturing divisions of Westinghouse throughout the country participated in the scrap clean-up campaign. The amount collected was in addition to the company's regular scrap savings of about 29,000 tons during the same period.

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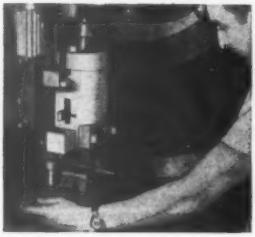

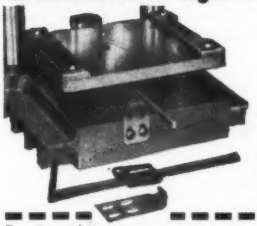

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USE MARGIN IF NECESSARY

SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

R-F Induction Heating Hardens Shuttle Tips Better, Faster

Radio-frequency induction heating is hardening several million textile shuttle tips per year at the Charles A. Richardson Company, West Mansfield, Mass. The equipment, shown in Figure 1, is doing a better job than the old oil-fired furnaces—increasing production and decreasing rejects, floor space required, smoke and fumes.

With r-f heating, it is possible to "selective"-harden the shuttle tips—24 different sizes of them—at production rates of up to 3000 per hour. Selective hardening, by means of exact and automatic process control, produces a high degree of hardness at the point, where maximum wear occurs, and relative softness for toughness at the points of maximum stress. The hardness pattern is shown in Figure 2.

FIG. 1

Photos courtesy Westinghouse Electric Corp.

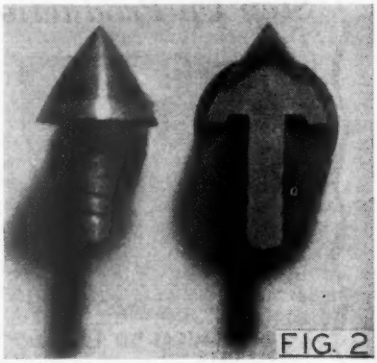
FIG. 2

The carburizing furnaces previously used require 200 square feet of floor space; the Westinghouse 20-kw r-f generator and integral work-handling equipment require less than 30 square feet. The equipment is fully automatic and can be operated by unskilled labor.

The work-handling equipment is arranged for manual loading, with automatic position, hardening and discharge. A process timer built into the machine controls the positioning, heating and quenching cycles, and reduces rejects because of uniformity of heat treatment.

★ ★ ★ ★ ★

Cites Importance of Safety Engineering Study

No engineering education is complete without a study of safety engineering, H. W. Heinrich, assistant superintendent of the Engineering and Loss Control Division, Travelers Insurance Company, Hartford, Connecticut, declared at the recent 72nd annual meeting of the American Society of Mechanical Engineers, held in Atlantic City, New Jersey.

Mr. Heinrich advocated the integration of safety engineering with existing studies and described a method that can be carried out without additional time for either the instructor or the student in an already full schedule.

"A moral obligation rests on both the college and its graduate engineers," he said. "This can be discharged only when due regard for health, safety and property damage is exercised towards those who may be affected by the work for which the engineer is responsible."

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A Practical Guide to the selection, application and heat treatment of steels for plastic molding is now available in the form of a 40-page book, "Tooling Up for Plastics," issued by The Carpenter Steel Co. The book offers tips for the buyer of plastic molds, solutions to problems encountered in plastic tooling, and information on how to select a mold steel to obtain better results and lower molding costs. It contains a Mold Steel Selector Table that gives in brief form the application of a complete line of mold steels, together with their characteristics. Write to THE CARPENTER STEEL CO., Dept. T&P, 122 W. Bern St., Reading, Pa., for a copy of this book.
Circle Inform-A-Gram No. C1.

A 38-Page Handbook on Metal Sawing has been published by W. O. Barnes Co., Inc. This highly illustrated book covers all types of metal cutting from the standpoint of elementary as well as advanced instruction. It also contains numerous charts, graphs and tables to help users and buyers of saws. The handbook is equipped with a pocket on the inside back cover for the insertion of Barnes' latest product descriptions and list prices. Address W. O. BARNES CO., INC., Dept. H, 1297 Terminal Ave., Detroit 14, Mich.
Inform-A-Gram No. C2.

"Alloy Welding Electrodes for Defense Production" is an attractive new brochure published by Alloy Rods Co. It details some of the armament welding experiences of World War II and discusses new electrodes that have become available since that conflict. The histories of many electrodes, as well as their properties and uses, are outlined. Write ALLOY RODS CO., Dept. T&P, York, Pa., and ask for Bulletin AR51-1.
Circle Inform-A-Gram No. C3.

"New Departure Engineering Service" is the title of a series of five booklets edited primarily for machine designers and other engineers interested in the application of ball bearings. Individually, these booklets are entitled as follows: Part One, BEARING APPLICATION—Principal Ball Bearing Types and Fundamentals of Mounting; Part Two, DETAILS OF DESIGN of Shafts and Housings for Ball Bearings; Part Three, ENCLOSURE AND LUBRICATION of Ball Bearings for Various Services; Part Four, BEARING LOAD COMPUTATION; Part Five, APPLICATION PROCEDURE—A Brief Outline of Principal Steps in Developing Average Bearing Mounting. Address NEW DEPARTURE, Div. General Motors Corp., Dept. T&P, Bristol, Conn.
Circle Inform-A-Gram No. C4.

The Houghton Defense Production Data Book is a 48-page, factual record of heat treating and metalworking experience in processing shells, cannon, small arms, ammunition and rockets. It contains new processing data, as well as articles reprinted from the company's war production supplements to "The Houghton Line" published before and during World War II. The reprinted articles cover many phases of munition making and were based on field experience. Where there have been important changes, explanatory notes have been added. Send requests for this valuable book to E. F. HOUGHTON & CO., 303 W. Lehigh Ave., Philadelphia 33, Pa.
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"Incentive Management" is a new book by James F. Lincoln, President of The Lincoln Electric Co. It details Mr. Lincoln's internationally known incentive philosophy—a philosophy that the author feels will allow workers and managers in business and industry to develop themselves as skillful individuals and to work together cooperatively to everyone's benefit rather than at cross purposes to everyone's expense. This 288-page book has a 6"x9" page size and is bound in gold embossed cloth covered board. Price is $1.00 in the United States, $1.50 elsewhere, postage prepaid. Write direct to THE LINCOLN ELECTRIC CO., 22801 St. Clair Ave., Cleveland 17, Ohio.

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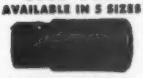

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SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

. . . Stainless Steels, from page 167

the change in scale condition is slow to develop, these solutions are materially beneficial in supplementing the acid solutions in obtaining complete and uniform removal. The softening of the scale, however, does not compare with that experienced with the molten alkalis Ex. —Method 2, Step 1); this latter method having the advantage of low cost, less time for removal of scale as compared to straight acid pickling, and negligible metal loss and surface attack.

The nitric-hydrofluoric acid mixture is an ideal bath for the removal of scale that has been previously loosened; however, care must be taken since the fumes are very irritating to the eyes and respiratory membranes. Thus, adequate ventilation should be provided. Care should be also taken in handling this mixture or hydrofluoric acid since burns resulting do not heal very readily. In addition, the solution may tend to pit when exhausted and is quite corrosive. The caustic soda-potassium permanganate solution (Ex.—Method 3, Step 2) is ideal in removing a light scale that has formed on a dense surface, although it also aids in rotting heavy scales and facilitates acid pickling.

The selection of pickling equipment is sometimes a serious problem. For alkalis and alkaline solutions steel tanks can be used. Sulfuric acid solutions can be accommodated in either acid resistant brick, lead lined steel or wood tanks, or wood coated with a good grade of asphalt paint. The nitric-hydrofluoric acid bath can be accommodated by carbon brick lined tanks, wood or concrete coated with a good grade of asphalt paint.

The high carbon martensitic stainless compositions should never be pickled in the fully hardened condition; stress relieving after hardening and prior to pickling is essential to avoid pickling cracks. Care should also be taken in pickling these grades in the fully annealed condition since their corrosion resistance to either nitric or the nitric-hydrofluoric solutions is low. This may result in a definite roughening of the surface, especially when they are overexposed to these acids.

Hydrogen embrittlement of the hardenable stainless steels when in the fully hardened condition may be expected upon exposure to such reducing acids as hydrochloric, hydrofluoric or sulfuric acids. This may occur where formed springs are heat treated and subsequently pickled; this embrittlement may be overcome by baking at 200° to 600° F., in air or, preferably, in steam.

★ ★ ★ ★ ★

Ultra-High-Speed Movie Camera Is New Research Tool

What causes the chattering of a high-speed tool cutting steel in a lathe? The answer to this and other questions concerning high-speed phenomena has been brought one step nearer with the development of an ultra-high-speed motion picture camera.

The new camera was developed by Battelle Memorial Institute, Columbus, Ohio, as a research tool. It is designed to take pictures at speeds up to 100,000 frames per second. That is about ten times the speed of most commercial high-speed cameras.

Its designers, Battelle Technologists C. D. Miller and Arthur Scharf, say that "with the new camera we hope in time to find answers to questions that have confronted science and industry for a long time. What causes knock in a piston engine is but one example of the type of problem we're prepared to tackle."

According to its designers, the new camera presents an unusually attractive combination of features. It resolves 30 to 40 lines per millimeter on 8-mm. film. Thus, detail and clarity of photographs are comparable to those obtained with cameras operating at much lower speeds. Effective lens openings can be made as large as f/2. A single photograph series of 500 frames can be projected as a motion picture immediately after development of the film without reprinting and re-registering of frames.

The Battelle camera takes all photographs through the same lens from the same viewpoint. This avoids the distortion of objects from frame to frame, which occurs when several lenses are used.

"Notes on Pyrometry" is an informative magazine reprint obtainable from Tempil® Corp. Written by Dr. G. M. Wolten, director of research and development for Tempil®, this paper provides an authoritative discussion of a subject about which misconceptions are common. Address TEMPIL® CORP., 132 W. 22nd St., New York 11, N. Y.
Circle Inform-A-Gram No. C6.

Essential Facts About Grinding are contained in a 30-page Norton booklet. There are more than 50 questions and answers that every grinding machine operator should know. Write to NORTON CO., 1 New Bond St., Worcester 6, Mass., for a copy of this "What, Why and How" publication.
Circle Inform-A-Gram No. C7.

"Planned Lighting for Industry" is a comprehensive, 47-page bulletin published by General Electric. Its highly illustrated pages cover such subjects as "Six Recommended Lighting Systems for Industry," "Fluorescent, Mercury or Filament?" "Distributing the Light" and "Specific Techniques for Special Seeing Needs." Write for your copy of this publication, designated Bulletin LD-4, to GENERAL ELECTRIC CO., Engineering Div., Lamp Dept., Cleveland 12, Ohio.
Inform-A-Gram No. C8.

Data on Wet and Dry Cutting of various materials, along with information on abrasive cutting machines and their maintenance, are included in a new Allison catalog. A unique color-coated chart gives recommendations for the selection of both Allison rubber bonded and resinoid bonded wheels. Various makes of cutting machines are illustrated. THE ALLISON CO., 257 Island Brook Ave., Bridgeport 8, Conn.
Inform-A-Gram No. C9.

Welding Electrodes. Raven Steel & Tool Co., Inc., offers a 44-page booklet featuring Austrian-made Bohler Welding Electrodes. Tables are included on physical properties, applications, load conversion and other data. Send your request to RAVEN STEEL & TOOL CO., INC., 100 E. Hawthorne Ave., Valley Stream, L. I., N. Y.
Circle Inform-A-Gram No. C10.

"Foundry Work," by Edwin W. Doe, is a new book that is intended to teach the simple principles of foundry practice. This 109-page book was prepared in cooperation with The American Foundrymen's Society. Price is $1.76. Write direct to the publisher, JOHN WILEY & SONS, INC., 440 Fourth Ave., New York 16, N. Y.

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Machining by Remote Control

A robot machinist that will operate a machine tool from an engineer's office or other distant point, has been built by Daco Machine and Tool Company of Brooklyn, New York. Remote control possibilities are practically unlimited; it would be just as easy to have a robot located in Detroit, for example, operate, via teletype, machine tools in Los Angeles or New Haven, according to Daco engineers. "The day of the automatic factory has been brought closer by the robot machinist," Al Stauber, managing partner of Daco, said in making the announcement.

Ideal for mass production plants having long repetitive runs of metal-cutting operations, the robot has wide application in all types of defense production. Complicated machining operations would no longer depend on the skill of the operator; the "skill" lies in the electric robot.

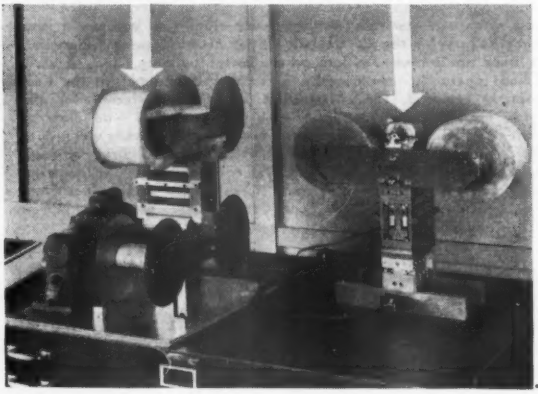
The parts that make up the device are a paper-type perforator, a sensor that translates the tape message into electrical impulses that actuate selsyn motors which, like the operator's hands, tell the machine what to do. Perforations in the tape represent essential dimensions shown on the blueprint for the part to be machined. When the tape travels through the sensor, electrical contacts are made and broken through the holes to complete and break electrical circuits. This produces varying voltages in the sensor that accurately control movement of the cutting tool and workpiece in the machine.

Unlike similar electronic "brains," machining accuracy is in no way influenced by the robot. Deviations in the dimensions of the machined part, if any, are the fault of the tool.

About the only manpower needed around the machine tool is for loading and unloading the work. As is usually done, dimensions will be checked periodically to see that parts are within tolerance limits, and to determine when worn parts need to be replaced.

The robot is flexible too because it is not wedded to the machine tool. Once a production run is completed on a given machine, the "brain" can be attached to another to do a completely different job.

Brains of the device are in the tape. It can be punched out by a draftsman who makes computations from a blueprint. In effect, he places the part drawing over a grid like graph paper. Holes in the tape represent points and surfaces on the part. A plant operating such robots would probably keep a file of master tapes representing various arcs, flat surfaces and fillets. To set up a tape for machining a part, a series of master tapes of the right combination could be fastened together.



The heart of the newly-developed automatic machinist is a punching mechanism that translates blueprint coordinates into taper perforations (left). The sensor (right) converts these perforations into electrical signals.

Photo courtesy Daco Machine and Tool Co.

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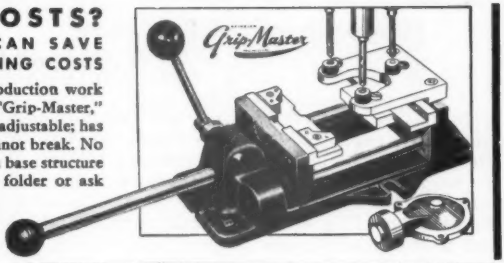

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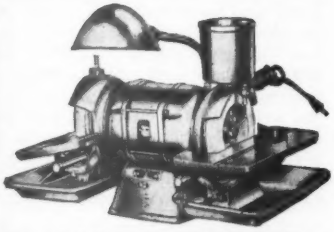

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Connecting Rod Balancing Expedited by New Machine

Balancing connecting rods used in automotive engines ordinarily is a rather slow process. Both ends of the rod must be weighed and, if weights are outside specified limits, the excess metal must be removed. This is usually from each end to effect the required balance. Often it is difficult to determine when the correct amount of the metal has been removed.

With the Snyder balancing machine recently installed by Studebaker Corporation, South Bend, Ind., guesswork is eliminated and the whole job is expedited. As the illustration indicates, the rod is set over pins where it is supported on knife edges of the weighing mechanism. Above each end is a shadowgraph that indicates the weight of the corresponding end. As soon as the indicators come to rest, a button is pressed and the corresponding milling cuts needed to bring the rod into balance are made automatically thus bringing the rod into balance. Cuts are made by milling cutters, each of which removes just the right amount of metal. All the operator does is to load the rod, press the button and remove the rod after the cuts are completed. Naturally, this makes the balancing job far faster than when a weighing device separate from the machine is used. It also avoids the possible human error of setting the machine for a cut of a correct depth.

Although the machine is automatic, it is possible to set it manually in the event that the rods happen to be so heavy that cuts needed exceed the capacity of the cutters employed. In that event, two cuts can be made, the first to remove part of the metal that must be cut away and the second to bring the rod ends to correct weight. This makes it unnecessary to change cutters for balancing a rod of excessive weight.

A Snyder balancing machine operating in the Studebaker plant. Shadowgraphs indicate the lack of balance at each end and automatically set the milling cutters to remove the correct amount of metal to effect proper balance.

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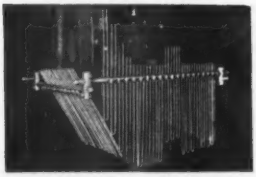

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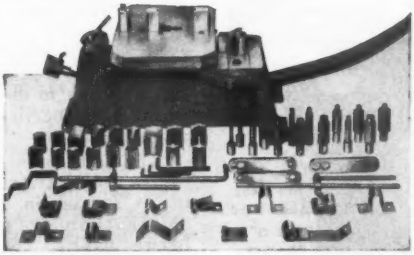

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"String Saving" Small Plants Curtail Production

Many small plants impede production because they are "string savers," Frank K. Shallenberger, associate professor of industrial management, Graduate School of Business, Stanford University, told the recent annual meeting of the American Society of Mechanical Engineers in Atlantic City, N. J.

Poorly planned plants cluttered with miscellaneous "junk," and hampered by antique equipment make good shop "housekeeping" impossible, he said, laying the blame on over-conservative and unimaginative management.

Small plants of fewer than 50 employees comprise more than 80 per cent of manufacturing plants in the country. Their part in defense mobilization will depend on their productivity, a problem of manpower, plant and equipment, and management, Prof. Shallenberger pointed out.

Professor Shallenberger deplored the haphazard selection of employees in most small plants. He said they should be selected by the owner-manager himself. The management competence of the owner-manager is the greatest single factor in the success of the company, he stated, adding that in most small plants "the first training problem —training the boss."

The foreman in a small plant has extra responsibilities which in a larger plant are handled by staff people. While a formal training program may not be justified, the company can use supervisory round tables, adult training courses in nearby schools, reading programs, visits to other plants and membership in foremen's organizations to develop its supervisors, he said.

"The need for effective worker training is greater in a small than in a large plant, for workers must be more versatile and flexible," the educator said, adding that they usually have to learn their jobs "the hard way."

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In Prof. Shallenberger's opinion, wage incentives are not necessarily the best means of motivating good workers. A group bonus, he said, based perhaps on labor cost as a percentage of sales, is likely to be more effective and less costly than individual incentives in the small plant. Profit-sharing may be effective in stimulating the small group responsible for management decisions, he added.

In the small plant there is a real challenge for the machine tool industry to develop inexpensive, versatile and yet highly productive equipment, he stated. "New thinking in this field already promises economical equipment ideally suited to the needs of the small manufacturer. Clever and imaginative jigs and fixtures can go a long way in transforming the general purpose machine tools of the small shop into efficient, high production equipment. They can reduce fatigue, operation time and operator skill requirements, and need not be elaborate or expensive," the Stanford professor said.

"The typical small plant is too complex for efficient operation by one man," he warned. "The small plant must divide the job logically and assign the functions clearly. It must develop in subordinates the ability to carry these responsibilities and must somehow develop means of control and of insuring competent performance." A productivity committee of all supervisory personnel might meet regularly to consider plant operating problems, said Prof. Shallenberger.

Plants of 30 to 50 employees might well afford a one-man staff, a sort of jack-of-all-trades to handle production control, quality control, cost control, stores control and other plant management functions to the extent that they cannot be readily delegated to the line, he said. Every year our business schools and some of our engineering schools turn out many men qualified for this assignment and anxious to work in small business, he declared.

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50,000 Pounds of Inspection Table

The above view of an operation involving ultra-precise inspection of dimensions, tolerances and other engineering details during production of metal stampings at the Toledo, Ohio, plant of City Auto Stamping Company, reveals some unusual and interesting facts regarding the layout plate employed for that purpose.

The equipment consists of a single block of granite having no seams, flaws or soft spots. The stone was cut with an overhanging ledge en bloc, measures 192″ x 96″ x 32″, and weighs 50,000 pounds in finished form. Reported to be the largest block of granite ever quarried, it is installed on a 32″ concrete foundation and rests on three rubber cushions placed between the foundation and stone itself.

The extremely hard surface of the plate is lapped to .002″ over-all flatness and is equipped with 20 drilled holes which are 2″ deep, each hole being fitted with metal lugs threaded to half-inch diameter in order to firmly secure objects during test operations. Being non-magnetic and proof against warp, expansion or shrinkage, the table's true horizontal plane affords a dependable means for accurate inspection of products during press runs. The company produces major stampings and assemblies for manufacturers of automobiles, motor trucks, tractors, farm machinery, household appliances including refrigerators, washing machines, ironers, dryers, stoves, ranges, metal furniture, power tools and other durable goods.

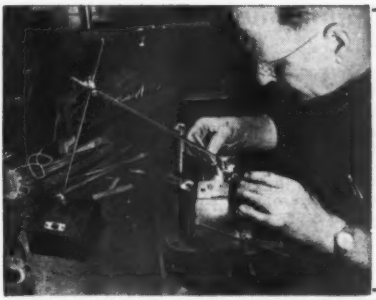
★ ★ ★ ★

Guide for Selling to the Air Force

A new edition of the booklet, "A Guide for Selling to the United States Air Force," is now available. The booklet, produced at Headquarters, Air Material Command, in Dayton, Ohio, explains the what, where and how of Air Force procurement and is a revision of the original "Follow Me" booklet, published in 1949.

Air Force buying procedure has undergone many changes since the Korean war, the most prominent of which is the acceleration of the Air Force's small business program. The Government is attempting to bring more small businessmen into the procurement picture, and the information in the new booklet is slanted especially at this segment of American industry.

Persons interested can obtain copies by writing direct to the Commander General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, Attn: MCPAXC-1, Contractors Relations Section.



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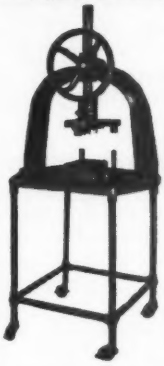

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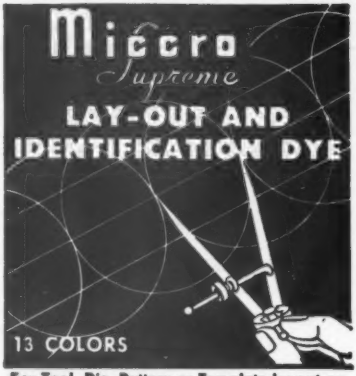

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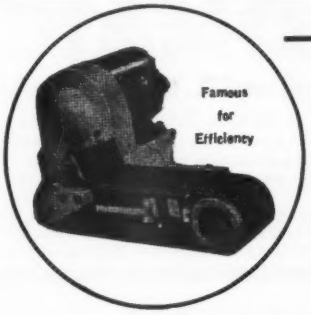

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Other styles and sizes in New Manual on finishing — Write today

WALLS SALES CORP.
333 NASSAU AVENUE BROOKLYN 22 NEW YORK

SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

Roll Marking Die Improvements

By incorporating a standard inclined plane (or cam) starting pad on roll marking dies, uniform depth of impression on parts is assured. This also helps the screw machine operator in tooling setup, since special cams or feeds on the machine are not required.

The starting pad on the marking roll die should contact the part to be marked during the last $\frac{3}{16}$" forward feed of any conventional screw machine cam.

Popularity of the C-style roll marker, incorporating the inclined plane starting pad roll dies, has led to this model (having an offset shank) being standardized for production by the manufacturer. Produced in quantities, it is available on short delivery. Die delivery time has also been cut by standardizing on the roll diameter. Roll dies and automatic markers are still available to meet special requirements.

Other improvements on the new model include: center of roll die is in line with top of shank for easier locating of holder during setup; ratchet pawl mechanism has been simplified and trips the roll die to reset it during the last $\frac{1}{16}$" to $\frac{3}{16}$" of the stroke; solid instead of split yoke construction.

Other features of the roll marker include: only two Allen-head screws need be removed to replace roll dies (this can usually be done without disturbing setting of holder in machine); elimination of drag of roll die or type face on marked surface.

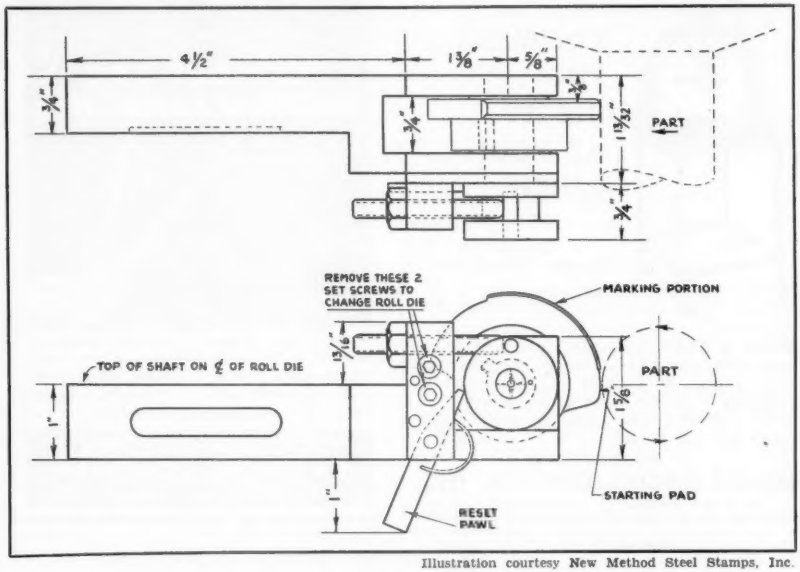

Illustration courtesy New Method Steel Stamps, Inc.

★ ★ ★ ★ ★ ★

New Representatives for Onsrud and A. Milne

Onsrud Machine Works, Inc., Chicago, manufacturers of high speed production metalworking and woodworking machinery and equipment, have announced the appointment of Babcock Machinery Company, 1904 Times Building, New York City, as Onsrud representative in the New York area.

Another recent appointment is that of Edward J. Silk as Connecticut sales representative of A. Milne & Company, solid and hollow tool steel distributors, New York City. Mr. Silk's headquarters will be at Milne's New Britain, Connecticut, office and warehouse, 172 Stanley Street. The same firm has also named Courtland W. Schefer as manager of Milne's Philadelphia office and warehouse, 337-339 North Orianna Street, Philadelphia 6, Pennsylvania.

ETALON No. 17 $19.95 FOB N.Y.

HARDENED STAINLESS STEEL

Known the world over for fine accuracy. Hand fitted vernier assures smooth, snug operation. COMPLETELY GUARANTEED. Supplied in ENGLISH or ENGLISH and METRIC Graduations. Furnished in handsome form fitting wooden case.

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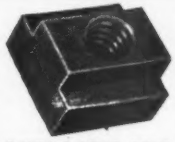

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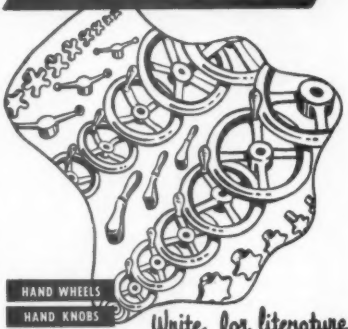

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. . . for Fast Production on Light-Gauge, Large-Panel Metal Stampings.

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3425 E. OLYMPIC BLVD., LOS ANGELES 23, CALIF.

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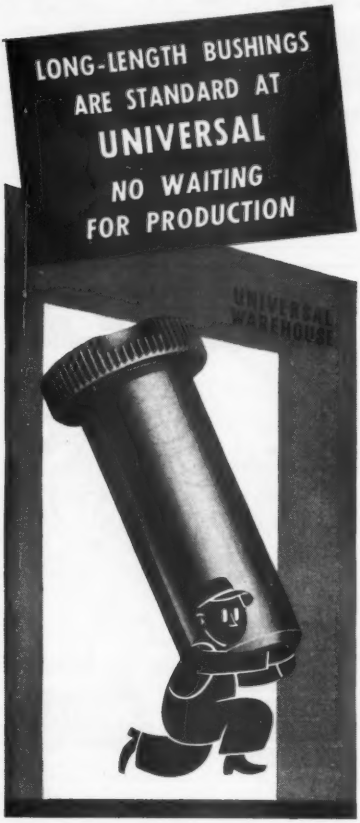


All long-length bushings listed as standard in the Universal Catalog are regular stock items, which means speedier delivery to you.

146B

UNIVERSAL
ENGINEERING COMPANY

New Press Boosts Production of Deep-Drawn Washer Tubs

A new double-action hydraulic press installed by the City Auto Stamping Company, Toledo, Ohio, has many design innovations to speed production and control quality of deep-drawn washer tubs. For example, the press has two drawing speeds in addition to its quick advance speed. The fast draw is done with 250 tons, using the main cylinder only; the slow draw with 500 tons pressure, using main and three additional cylinders. Blankholder pressure is adjustable at all four corners.

A pressure switch safety feature of the press prevents descent of plunger until blankholder pressure has been registered on all four corners. Converted to a single action press, full 750 tons capacity is available.

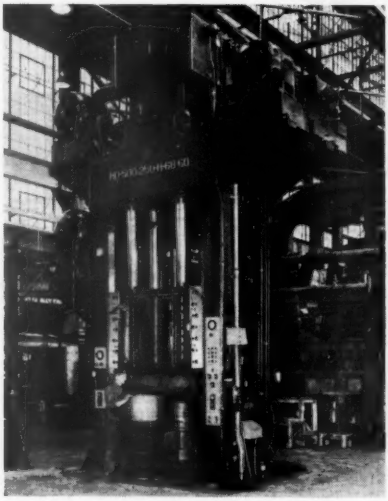


Photo courtesy E. W. Bliss Company

A locking type selector switch simplifies changeover from single-action to double-action operation or vice versa. Another selector switch permits immediate or delayed ejection through a lockdown device. Indicating lights, built into the press, are connected to the motor starter.

Boring Aircraft Rocket-Housing Tubes

The job shown in the illustration is an aircraft rocket-housing tube being bored on a Hydro-Borer at the plant of an aircraft sub-contractor. The material is 61ST-6AL aluminum tubing, 3¼" OD x .187 wall thickness x 13.121 long. The job specifications called for the first operation to bore one end to a depth of

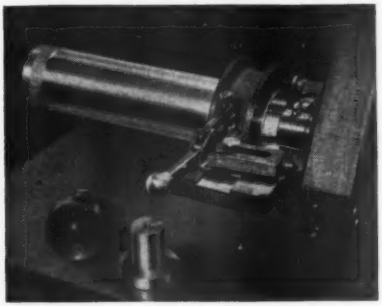


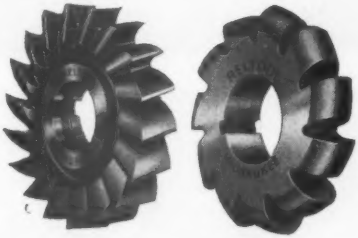
Photo courtesy Hydro-Borer Co.

.810 ±.005 with an ID of 2.937 ±.0005. The second operation was to bore the opposite end to a depth of 2.190 ±.005 to an ID of 2.937 ±.0005. A 40 micro inch finish was required.

The previous method of handling these tubes produced an out of round condition in the bore and ID and the 40 micro inch finish was not consistently held. This was eliminated on the Hydro-Borer which held absolute concentricity and produced a finish of 30 micro inches with tolerances of ".0003.

The Hydro-Borer was set up to feed to adjustable stops and return automatically. The work is held stationery and the boring tool, actuated hydraulically, moves into the work at a predetermined and constant rate of feed. Work holders were finished on the machine with the fixtures located on the 2" OD front bearing to insure the greatest accuracy.

The production rate on the one operation was stepped up from 82 to 112 pieces per hour while the other was boosted from 27 to 62 pieces per hour.



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Reltool offers a Full Range of Milling Cutters in all Types and Sizes for every standard milling operation, and for many special applications. This includes Keyseat Cutters — both Shank and Arbor Types; Plain and Heavy Duty, Side and Half-Side, Staggered Tooth, Helical, Angle, Shell End, Single- and Double-Angle, T-Slot-Straight and Taper Shank, Dovetail — 45° and 60° Angle. Convex, Concave and Corner Rounding Milling Cutters are available in both the Old Standard and in the New M.C.T.I. Standards.

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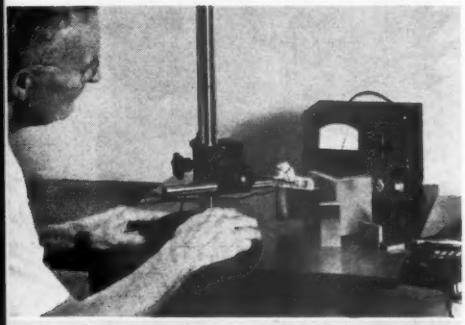
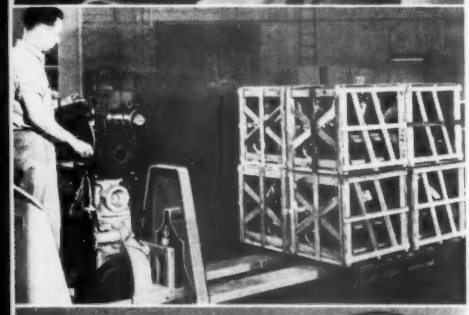
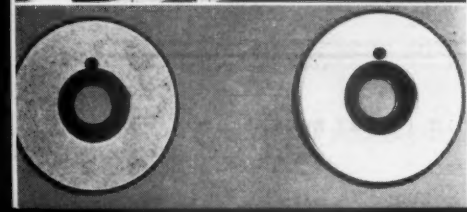
PROGRESS

NEW DEVELOPMENTS • IMPROVEMENTS • COST AND TIME SAVERS







The Indi-Ac Electronic Indicator is a portable, high-precision instrument for checking setups and runout on the machine and for surface plate work in shops, toolrooms and gage rooms. It consists of an induction-type gage head adjustably mounted on a stand, and a high-stability 4-tube amplifier with 2-scale meter. Illustrated Bulletin 101 is available from the manufacturer, GRAHAM-MINTEL INSTRUMENT CO., 735 Carnegie Ave., Cleveland 15, Ohio.

Circle Inform-A-Gram No. A1.

A Hand Wheel Operated Collet Closing Attachment has been added to the Crozier line. All wearing parts on this toolroom type attachment are hardened and the hand wheel is self-centering on the spindle. It is offered in three models having minimum bore of spindle .750", 1.062" and 1.375". Full data can be had from CROZIER MACHINE TOOL CO., Dept. T&P, Hawthorne, Calif.

Circle Inform-A-Gram No. A2.

Improved Surface Grinder. Shown at the left is the latest development in the lubrication system of the table ways on the Boyar-Schultz No. 6-12 Surface Grinder. The reservoir for holding the lubricating oil can be seen located in the center of the table. This reservoir is fed from a single oil cup conveniently located in the front and it eliminates oil cups. BOYAR-SCHULTZ CORP., 2112 Walnut St., Chicago 12, Ill.

Circle Inform-A-Gram No. A3.

The Truck-Man Industrial Truck now has increased horsepower in all models. The power change from 4.4 hp to 5.8 hp represents an increase of 32%. The greater power is the result of an increase in displacement from 13.5 cu. in. to 17.8 cu. in. Truck-Man is made in hydraulically operated Skid Lift and Pallet Lift models, Utility Platform and Tractor types. For a catalog, write to TRUCK-MAN DIV. of THE KNICKERBOCKER CO., 662 Liberty St., Jackson, Mich.

Circle Inform-A-Gram No. A4.

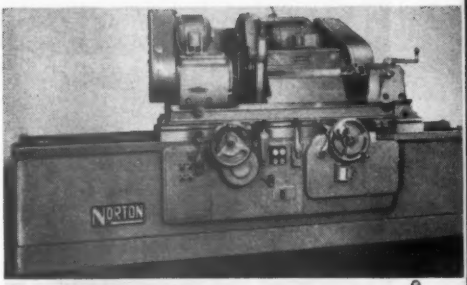
A Special Purpose Chemical Compound for barrel finishing alloy steel parts quickly is offered under the name Blue Magic Steel Finishing Compound C-5. With C-5 Compound and any generally used tumbling medium, bright mirror finishes can be put on steel parts in time cycles of 20 to 40 min. Pictured is a steel washer before (left) and after burnishing with this compound and an abrasive. BLUE MAGIC CHEMICAL SPECIALTIES CO., 2135 Margaret St., Philadelphia 24, Pa.

Circle Inform-A-Gram No. A5.

ON PARADE

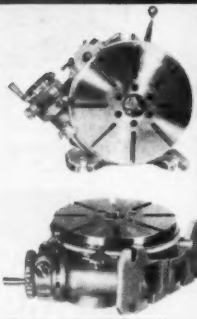
Mail FREE Inform-A-Gram Card for MORE Details.

Norton 18" Type LCTU Cylindrical Grinder rapidly grinds, to finest limits of accuracy and finish, light work requiring up to 18" swing. Such features as pre-set truing and grinding speed, click-count wheel feed indexing, automatic work rotation and coolant flow control, greatly simplify operation. Additional details can be secured by writing to NORTON CO., 1 New Bond St., Worcester 6, Mass.
Circle Inform-A-Gram No. A6.



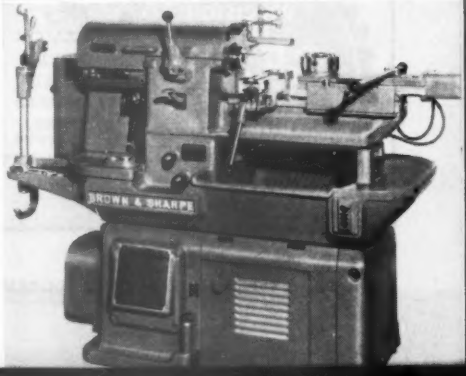
A Stock Checker's Truck (inside cut) designed to handle a variety of items or parts, with writing table and stationery rack welded to the frame, is being made by Palmer-Shile. It is of all steel welded construction with three steel shelves that have a 1" flange all around to prevent materials from falling off. The tubular steel handle of the truck extends to form a protective bumper for the stationery rack. PALMER-SHILE CO., 12665 Mansfield, Detroit 27, Mich.
Circle Inform-A-Gram No. A7.

The Griswold Indexing Table (outside cut) provides a high order of accuracy in use with milling machines, jig borers, die sinkers, etc., for indexing and rotary milling. It can be used in either a vertical or horizontal position. Readings accurate to .0005" are possible at periphery of 12" circle. As the diameter of the circle decreases, accuracy increases. The reading is made at a normal viewing distance. F. T. GRISWOLD MFG. CO., Dept. T&P, Wayne, Pa.
Circle Inform-A-Gram No. A8.

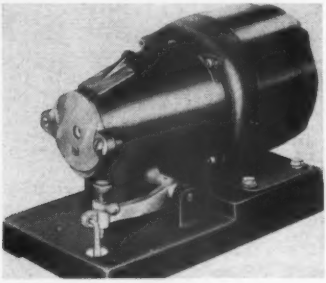


Two New Reid Compression Spring Assortments have been announced. The large assortment consists of 60 springs, two each of 30 different sizes, and the small one has 30 springs, two each of 15 different sizes. All are made of music wire. They range in diameter from $\frac{3}{32}$" to ½" and are made in 10" lengths. REID TOOL SUPPLY CO., 709 Baker St., Muskegon Heights, Mich.
Circle Inform-A-Gram No. A9.

New B & S Hand Screw Machines have many outstanding new features. One of these is the spindle with its wide range of speeds and ratios. The full-antifriction-bearing spindle has positive chain drive at all speeds and a completely enclosed drive. One hundred and ninety-six 2-speed combinations are provided. Complete specifications on all models are contained in literature from BROWN & SHARPE MFG. CO., 235 Promenade St., Providence 1, R. I.
Circle Inform-A-Gram No. A10.

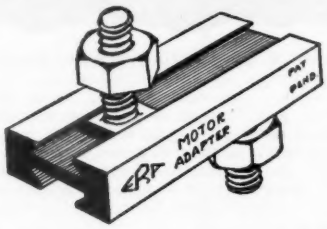


The High Speed Wire Stripper is designed primarily to put this operation on a production basis. It has special alloy steel circular cutting knives that instantly and completely remove insulation from solid, stranded or multi-conductor cable up to ½" dia., and the stripping length is adjustable up to 1½". Its ¼ hp, 110 v, direct connected motor comes ready for any convenient outlet. HIGH



SPEED HAMMER CO., INC., 304 Norton St., Rochester 21, N. Y., will provide full particulars on the wire stripper.
Circle Inform-A-Gram No. A11.

Motor Base Adapter Plates will keep all machines in operation and practically eliminate down time due to motor failure. They



will fit the base of any motor up to and including 3 hp; no drilling or filing is necessary. The motor can be shifted forward or backward to obtain the proper belt adjustment and right or left for exact pulley alignment. An adapter set consists of four very thin plates, eight bolts—washers and hex nuts. Write to the manufacturer, ENGINEERING RESEARCH ASSOCIATES, INC., 3475 East Nine Mile Rd., Hazel Park, Mich., for additional information and literature on these adapter plates.
Circle Inform-A-Gram No. A12.

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Any decimal diameter to ¾"—in any length. Mirror finish surface to gage tolerance. Many uses — punches, gages, measuring wires, special tools, etc. Quick delivery.
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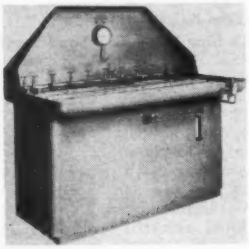
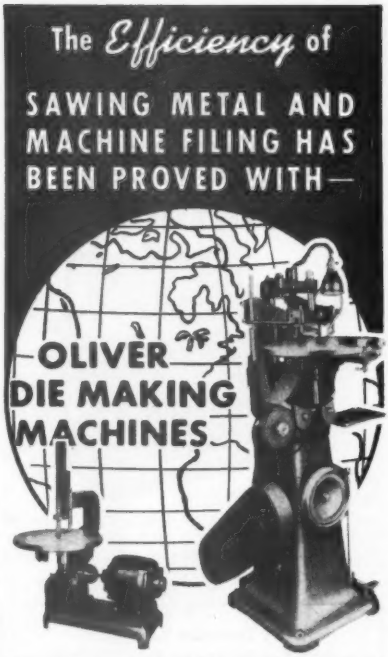
Illustrated Is a Hydraulic Test Stand designed for testing flexible hose used in aircraft. With variations, this stand can be adapted to the testing of valves, cylinders, etc. These stands are built to provide test pressure up to 5000 psi, using large volume



pumps, and up to 30,000 psi, with special booster equipment. SUPERDRAULIC CORP., 14256 Wyoming Ave., Detroit 4, Mich.
Circle Inform-A-Gram No. A13.

The "Sevo" Swedish Vise instantly clamps round, tapered or irregular objects. Its jaws consist of a series of machined and ground flat plates that hinge or swivel in any desired direction to coordinate with the shape of the held object. These jaws are so designed that they can be moved in relation to each other,

and the workpiece can rest on a contact surface underneath. By turning the main screw, the locking jaws are made to position themselves. DE WILDE-JONES, INC., 181 Steuart St., San Francisco 5, Calif.
Circle Inform-A-Gram No. A14.



Throughout the world, in thousands of plants, Oliver Die Making Machines are in continuous use — in fact, many of them for more than 25 years. In addition to their efficiency, speed and accuracy, where savings in time and costs amount up to 60%, they offer the added advantage of not requiring skilled labor for sawing, filing and lapping operations. Be Wise, Oliverize — get faster and more accurate die making with Oliver Die Making Machines.

OLIVER DIE MAKERS
Available in 5 Models

The Bench Model S-1 (illustrated) is a single speed die maker for use on tool steel up to 1" thick.

The Heavy Duty Model (illustrated) has 6 speeds, works in metal up to 3" thick, has variable strokes to 5" with hydraulic feed.

***Write Today For Complete Technical Data on* OLIVER DIE MAKERS**

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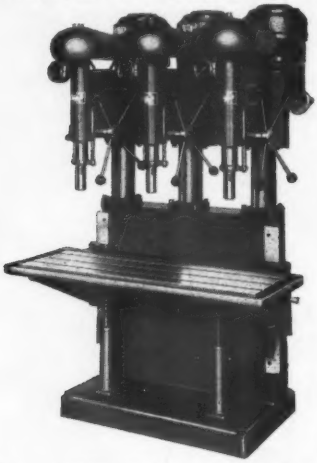
5436 E. MAUMEE · ADRIAN, MICHIGAN

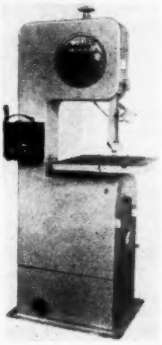
SEE ADVERTISERS INDEX, PAGE 137, FOR KEY NUMBERS

Sibley Model ME-25 Multiple Spindle Drilling Machine has three spindles mounted integral to a sturdily constructed column, is suited to operator efficiency on high volume production. Unique among features for a machine of medium weight are its big 25" swing, a variable speed drive from which the exact spindle speed may be obtained for any size drill from ⅛" to 1", and an extra-large table with coolant trough. Address SIBLEY MACHINE & FOUNDRY CORP., Dept. T&P. South Bend 1, Ind.



Circle Inform-A-Gram No. A15.

DoALL's New Model SFP Band Tool Machine offers a 16" throat x 12" thickness capacity for light duty bandsawing, filing and polishing. It provides both high and low tool speed ranges—without changing belts, pulleys or motors. Speed is infinitely variable by handwheel control and two-speed geared transmission from 50 to 300 fpm and from 860 to 5200 fpm. More data on this versatile machine can be obtained by writing THE DoALL CO., Dept. T&P, 254 N. Laurel, Des Plaines, Ill.



Circle Inform-A-Gram No. A16.

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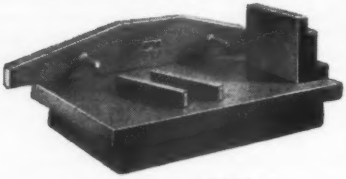
RAHN BLACK GRANITE

SURFACE PLATES—ANGLE PLATES
PARALLELS—STRAIGHT EDGES



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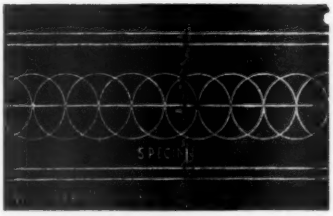

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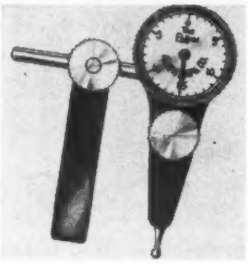
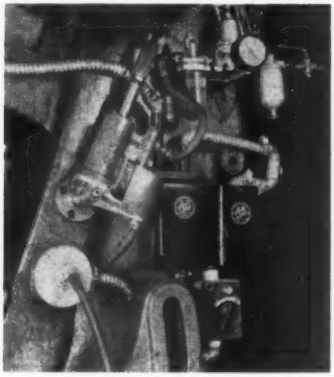
The New Elgin Dial Indicator combines excellent sensitivity with the greatest possible ruggedness. Among the features are an adjustable dial and a reversible action. The



dial is calibrated in thousandths of an inch and has a range of ± .015". A unique clamp on the back of the indicator accepts rods of from ⅛" to $\frac{5}{32}$" on one side, and up to ¼" on the other. GLORE INDUSTRIES, 2214 E. 75th St., Chicago 49, Ill.
Circle Inform-A-Gram No. A17.

Punch Press Guard Model No. AE 60 is particularly designed for direct clutch presses. The unit is electric-pneumatic operated; a set of electric start buttons for each operator is installed in a convenient place on the press, the buttons being located far enough apart so that the operator must use one hand on each button. Simultaneous pushing of both



buttons completes the circuit; then the Air Clutch operator engages the clutch, allowing ram to make one complete revolution. Both hands are out of danger as the ram descends TECH-N-KAL MACHINE & ENGINEERING, 12925 Auburn Ave., Detroit 23, Mich.
Circle Inform-A-Gram No. A18.

4-Burner $295
6-Burner $325
F. O. B. Factory

High Uniform Temperatures at LOW COST

Quick Acting JOHNSON No. 130A is available in two temperature ranges. 4-Burner unit is for steels requiring 1400—2350° F., and 6-Burner unit for 1800—2400° F. Powerful, efficient burners fire under hearth assuring fast, uniform heat. Save time and gas. Easily regulated. Firebox 7x13x16½ lined with high temperature insulating refractory. Complete, ready for action with Carbofrax Hearth, G. E. Motor and Johnson Blower. Order Today!

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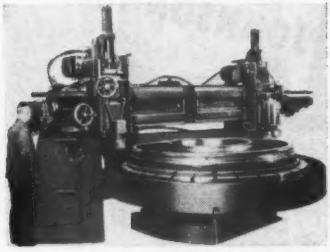
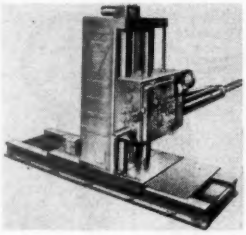
Frauenthal 2200 Series Grinders are double-head, heavy-duty, high-precision machines featuring super-accuracy in handling large internal, external and surface grinding, as well as light precision boring and turning. A combination of rugged construction and wide swing-range up to 150" dia. permits the grinding of diameters and parallelism faces consistently to a tolerance of .0002" to .0003" at their maximum swing. Details



can be had from A. HAROLD FRAUENTHAL, INC., Dept. T&P, Muskegon, Mich.
Circle Inform-A-Gram No. A19.

Horizontal Drilling & Tapping Machine. Kaukauna's new heavy-duty Model 3040 features column rigidity, unusual power, wide



range of movements, simplified operation and power positioning. All controls are grouped at the front of the headstock where they are within easy reach of the operator. Runway slides are heavily ribbed semi-steel castings guided and gibbed to the runways and contain a 3 hp gear motor and worm reduction to traverse column along the runway. Write KAUKAUNA MACHINE CORP., Dept. T&P, Kaukauna, Wis., for further information.
Circle Inform-A-Gram No. A20.

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Toolmaker Microscope

$461.00* Prompt Delivery. .0001" accuracy. 6½" x 6½" range. Net weight 38½ lbs.
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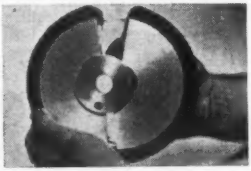
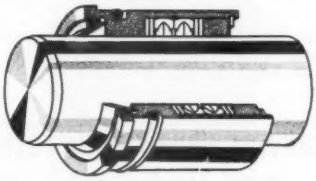
Cone-Loc Drum Sanders, made by American Diamond Saw Sales, Portland, Ore., are now being sold exclusively by Carborundum.



This cushion-type split drum makes it possible to use coated abrasives in low-cost strip form. A new backing flange assures a safe, strong, balanced tool. Details can be had by writing the nearest district sales office of THE CARBORUNDUM CO., or
Circle Inform-A-Gram No. A21.

Monopak-Cartridges, for air and hydraulic cylinders, combine all the necessary packings, bearings and rod-wipers into one compact unit. They can be installed or replaced



in a few seconds. They are designed to make best use of the long-wearing properties of "Monopak" packings and require no attention. HYDRAULIC ACCESSORIES CO., 439 E. Fort St., Detroit 26, Mich.
Circle Inform-A-Gram No. A22.

The I-G-C Relief Grinder speeds up all cutter grinding operations, is designed to be operated at maximum efficiency by unskilled help. With only two wrenches, the fixture is easily adjusted for the correct relief and angle in relation to the grinding wheel. It

fits any standard grinder, will handle work from $\frac{1}{16}$" to 1" dia. with standard collets. WESTERN AERO INDUSTRIES, 3305 Burton Ave., Burbank, Calif.
Circle Inform-A-Gram No. A23.

Precision Feeds For All Presses

- Easily installed on any press
- Can't slip. Reverse instantly
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- Maintain original setting. No ratchets or pawls to wear down and affect feed spacing.

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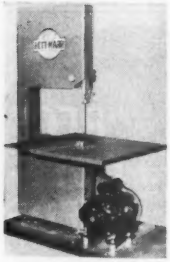
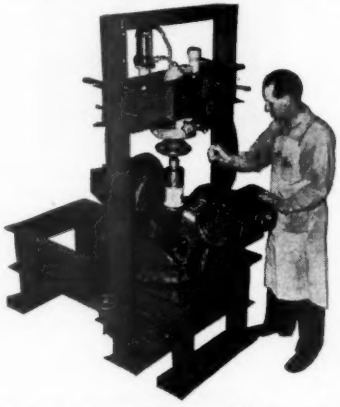


The New Bett-Marr Sheet Metal Saw cuts stacked (50 or more) galvanized sheet metal at speeds up to 15" per minute. It handles complicated cutting jobs for ductwork fittings in a fraction of the time necessary for hand-cutting. The smooth, powerful chain drive gear eliminates blade chatter and allows full power at slow speeds for cleaner, faster cutting of iron and steel castings, forgings, etc. Descriptive literature can be obtained by writing to the manufacturer of this saw, BETT-MARR MFG. CO., Dept. T&P, Hopkins, Minn.

Circle Inform-A-Gram No. A24.

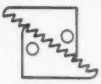
The Dake Movable Frame Press is designed to handle big, awkward parts. It has a large area table on which the work can be lowered by hoist or crane. Then the frame is moved over the table. The workhead can be moved from side to side along the frame channel, making it easy to center the workhead above the work laterally as well as longitudinally. Provision is made for the workhead to be moved up or down to adjust to the height of the work. Address DAKE ENGINE CO.,



Dept. T&P, Grand Haven, Mich, for complete specifications.

Circle Inform-A-Gram No. A25.

REID SET-UP AIDS



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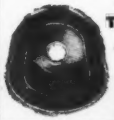

EISLER ENGINEERING CO. INC.
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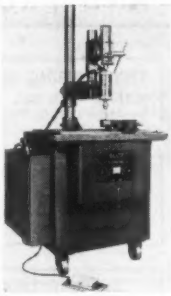
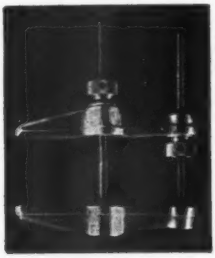
Newark N. J.

A New Elox Electron Drill, the M-7 Tapmaster, has been developed for the removal of broken taps, drills, reamers and studs at record speeds. It employs an "Electrode" (hollow copper alloy tubing available in various diameters) that is chucked into the "Disintegrating Head" and held firmly by a collet. ELOX CORP. OF MICHIGAN, 740 N. Rochester Rd., Clawson, Mich.



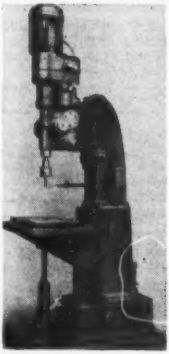
Circle Inform-A-Gram No. A26.

The Monarch Vise Action Clamp grips the work straight, like a vise, without side slipping. Hump design adds strength to this



fast, lightweight clamp. It has tough aluminum alloy jaws and precision threaded steel shafts. Spinning nuts of knurled steel have a pin opening for tight adjustment. C. B. TEETER, Tool Room Specialties, 4470 Oakenwald Ave., Chicago 15, Ill.

Circle Inform-A-Gram No. A27.



Precision Automatic Tapping and Threading Machines made by Karl Huller, Ludwigsburg, Germany, are available in five sizes from Carl Hirschmann Co. The largest—Model UG 5 Automatic for 1½" maximum dia. threads—is pictured. Operation cycles are entirely automatic; they have positive electrical controls. CARL HIRSCHMANN CO., 30 Park Ave., Manhasset, N. Y.

Inform-A-Gram A28.

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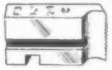

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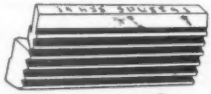

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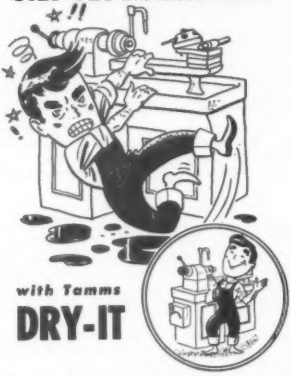

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Rayon flocked coated shield to resist heat. 25 and 40 watt bulbs included.

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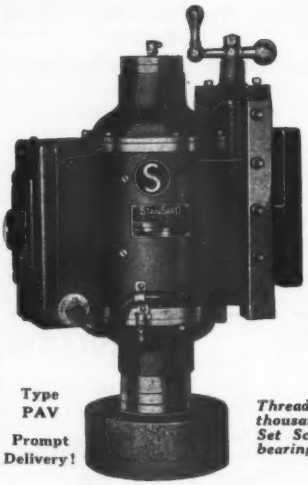

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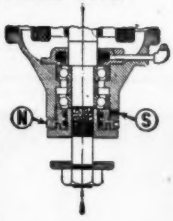

Threaded Nut "N" permits fractional thousandths adjustment by releasing Set Screw "S" to take up wear on bearings without removing wheel—no shims involved.

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grips work tighter
releases work quicker

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You reduce time lost changing "set-up" when you use Benco Master Collets since the pads are quickly changed without removing the collet from the spindle. "CB" Master Collets use the only pad that is interchangeable with any other pads intended for "CB" Collets of the same machine capacity, regardless of make of machine.

Benco Collets give you production speed and quality at the same time...that's why it pays you to insist on Benco.

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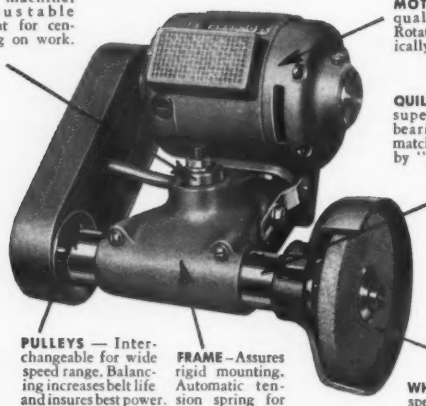
MOTOR — Dumore quality throughout. Rotating parts dynamically balanced.

QUILLS — Made with superprecision ball bearings individually matched. Lubricated by "Fog-of-oil."



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Mount a Dumore Grinder on the clapper box of a planer for surface grinding.

Dumore Grinder mounted on ram of shaper with right angle plate for surface grinding.

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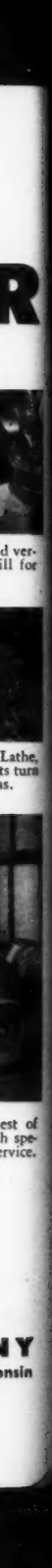
THE DUMORE COMPANY
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